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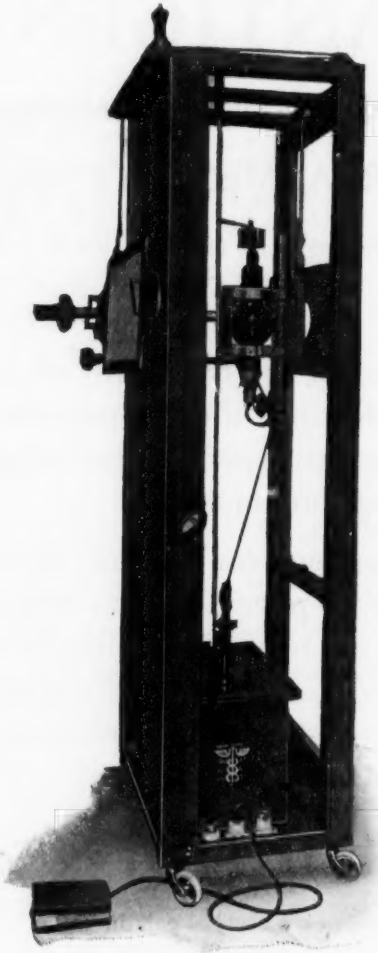

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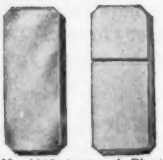

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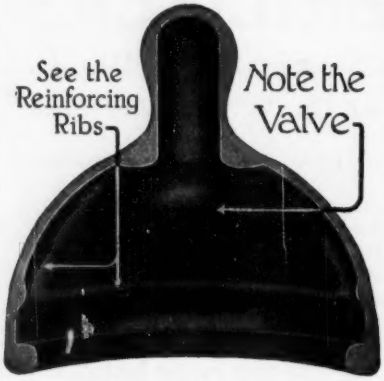

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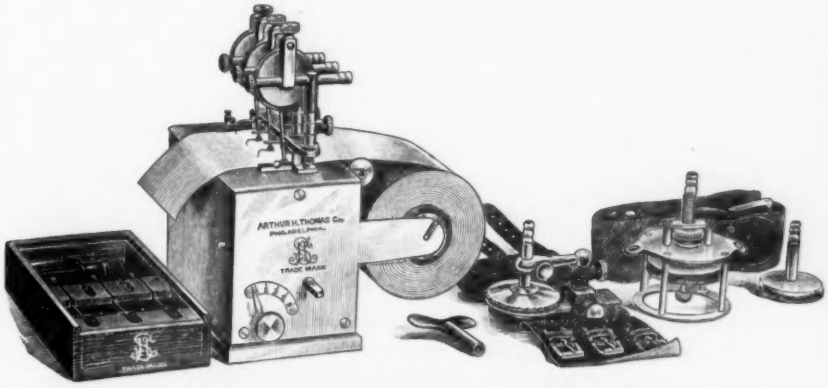

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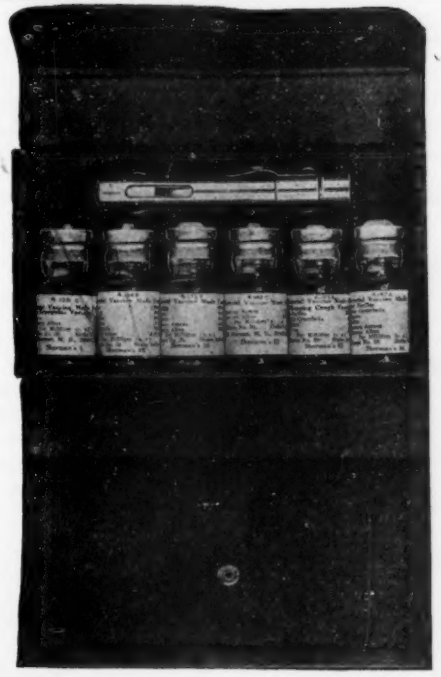

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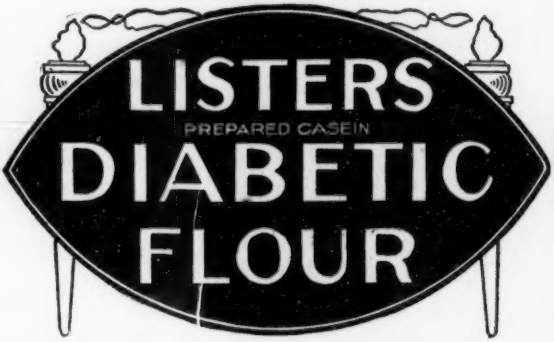

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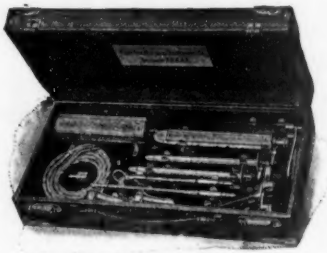

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OF THE MEDICAL SCIENCES

NOVEMBER, 1920

ORIGINAL ARTICLES.

SOME NEWER CONCEPTS IN DIGITALIS THERAPY.*

By Cary Eggleston, M.D.,

ASSISTANT PROFESSOR OF PHARMACOLOGY, CORNELL UNIVERSITY MEDICAL COLLEGE; ADJUNCT ASSISTANT ATTENDING PHYSICIAN TO BELLEVUE HOSPITAL, SECOND MEDICAL DIVISION, NEW YORK.

Not quite twelve years ago Mackenzie published his epoch-making work on *Diseases of the Heart*, which marked the beginning of a revolution in our knowledge of the physiology and pathology of that important organ. At about the same time Einthoven brought forth his string galvanometer as a clinical instrument for the scientific study of the mechanism of the heart-beat; and through the work of Mackenzie the polygraph had become an instrument of great clinical value. We were thus, all at once, provided with a new outlook upon the functions of the heart in health and disease and with instruments of precision for the study of these functions. During this brief span of years our knowledge of the heart's normal and pathologic physiology has been advanced far more than it had in the preceding century, and with this advance there came the opportunity for the more accurate investigation of the action of drugs upon the heart in man. Many such investigations have been made with reference to the actions of digitalis and the digitalis bodies, and it is with the results of some of these that the present paper is concerned.

Slowing of the heart has been regarded as one of the characteristic actions of digitalis in man ever since it was first observed by Withering. The most superficial observation should have revealed

* Read before the College of Physicians of Philadelphia, April 7, 1920.

swelling in the region of the inferior turbinate, whenever such swellings extend to and close the nasolacrimal outlet; dilatation of the latter also, as in ozena, may likewise cause disease of the lacrimal drainage apparatus through entrance of diseased products from the nose mechanically or by extension through continuity. The treatment in these cases is cure of the nasal affection. Dislocation of the globe by mucoceles and tumors are too well known to require special mention; the same is true of affections of the optic nerve. The possibility of reflex neuroses of the eye of nasal origin should also be borne in mind; proof of the rhinologic origin of cataract, glaucoma, etc., has not yet been furnished.

PATHOLOGY AND BACTERIOLOGY

UNDER THE CHARGE OF

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Streptolysin.—Although the use of the blood-agar plate for the differentiation of alpha and beta hemolytic streptococci has become quite general, there has been a lack of uniformity of method and but little attempt at standardization. Impressed by the fact that the hemolytic zones surrounding colonies of the beta hemolytic streptococcus were wider and clearer on 10 per cent. sheep's blood-agar plates than on those prepared from similar concentrations of rabbit and human blood, DE KRUIF and IRELAND (*Jour. Infect. Dis.*, 1920, xxvi, 285) have studied hemolysin production by these organisms on blood accessible to general use, in order to ascertain whether variations in suitability exist among these bloods and to determine their optimum concentration for maximum production. Beef-infusion broth was employed in all cases, being adjusted to a hydrogen-ion concentration of pH 7.8. The investigations included studies on human, rabbit, sheep and horse blood. Instead of following the previously described methods of titration of filtrates or whole cultures the authors titrated the supernatants of early broth cultures seeded with from eight to twenty-four-hour cultures of hemolytic streptococci against constant quantities of the washed erythrocytes. Extensive experimentation was carried out, the results being recorded by tables and graphs. It was found that lysin production reached its maximum for the strains studied at a very early period in the life of the serum broth culture. When the serum broth was inoculated with young (eight to twelve hours) cultures this peak was reached in from seven to eight hours. In older cultures the crest may be deferred to twelve hours. Heated serums were usually superior to unheated ones. Sheep and horse serum were superior in all concentrations to human and far superior to rabbit serum broth. From the results of their experiments the authors devised a new blood-agar plate with the idea of using the optimum serum concentration for maximal lysin production of a blood both efficient and available. Sheeps' blood

was recommended, the serum-cell mixture being made by adding 1 part of cells to 4 parts of heated serum. This mixture was then combined with liquid agar in the proportion of 1 to 3, so that the final concentration was serum, 20 per cent.; cells, 5 per cent.; and agar, 75 per cent. This medium was found to be not only suitable for demonstrating the hemolytic zones of beta streptococcus but efficient in exhibiting the multiple concentric zones of green production and hemolysis for alpha streptococcus and pneumococcus.

Experimental Streptococcus Empyema; Attempts at Prevention and Therapy by Means of Vaccine and Serum.—The importance of streptococcus empyema has not only not decreased but has become intensified during the last year or so by its occurrence as a fatal sequel to influenza as well as in its previous relation to spontaneous bronchopneumonia and bronchopneumonia after measles. GAY and STONE (*Jour. Infect. Dis.*, 1920, xxvi, 265) undertook the present study not simply in an effort to proceed toward a possible practical method of treating streptococcic empyema, but in a desire to contribute some information to the larger question of streptococcic immunity as a whole. The experiments were conducted on rabbits by means of a single pure strain isolated from the lung of a fatal case of bronchopneumonia complicated by empyema and pericarditis, and though culturally of the S. pyogenes group, was immunologically unclassified. Beef infusion broth, pH 7.2 to 7.4, and containing either 1 per cent. glucose or 5 per cent. sterile fresh rabbit serum, was the medium employed. In counting the bacteria it was found that the Wright method, when checked by the gravimetric tests, gave accurate and consistent results. The particular strain was not markedly pathogenic for rabbits by intravenous inoculation. Attempts to increase the general invasive properties of the cultures for rabbits were unsuccessful, as were all attempts to produce bronchopneumonia by bronchial insufflation. Empyema could be procured, however, by injecting small quantities of broth cultures into the pleural cavity, particularly when subcultures from the pleural fluid of an animal with fatal empyema which had been passed through the pleuræ of several animals was employed. Death occurred in from one to seventeen days, the average being five days. Of 103 rabbits injected by a constant dose of a uniform passage culture, 102 showed involvement of one or both chests, with or without pericarditis. There was no evidence of an elective localizing affinity with the strain used. If sufficient amounts of killed and subsequently living cultures of streptococci were given over a considerable period of time, protection against empyema occurred. The total number of bacteria injected, rather than the number of injections, seemed to be the decisive factor. The immune serums produced gave positive agglutination reactions at 55° C. in dilutions of from 1 to 400 to 1 to 12,800. The technical difficulties were surmounted by using a constant homogeneous suspension, made by the addition of phenol in a final concentration of 0.2 to 0.5 per cent. to a twenty-four-hour serum broth culture. The serum of the animals in which active immunity had been proved by intrapleural inoculation was found to vary in tropin content from five to eighty times that of normal rabbit serum. Satisfactory precipitin reactions were obtained

by the immune serums used for therapeutic purposes, the antigens consisting of extracts of ground and dried streptococci. It was shown that the immune sera which contained strong antibodies may have a preventive and curative action when given before, with and after the infecting intrapleural dose of bacteria. Attempted vaccine therapy of the localized empyema gave consistently negative results. The authors conclude that although distinct results in the prevention of experimental empyema and, in rare instances, the cure of empyema may be produced by the use of immune serum from rabbits, they have as yet no evidence of an encouraging serum therapy to offer and that no optimistic conclusions can be drawn from their results as to the possibility of protecting human beings against localized streptococcus infections, or, specifically against empyema, owing to the large amount of vaccine and the prolonged nature of treatment required.

HYGIENE AND PUBLIC HEALTH

UNDER THE CHARGE OF

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Pellagra Incidence in Relation to Sex, Age, Season, Occupation and "Disabling Sickness" in Seven Cotton Mill Villages of South Carolina during 1916.—GOLDBERGER, WHEELER and SYDENSTRICKER (*Public Health Reports*, No. 28, xxxv, 1650) conclude their study by the following summary: "(1) During 1916 the incidence of pellagra among the members of the families of white mill operatives of seven representative cotton mill villages of South Carolina was included in our study. (2) In a population of 4399 a total of 115 definite cases, representing a rate of 26.1 per 1000, was recorded. If 73 cases with ill-defined eruption recorded as 'suspects' are included, there were in all 188 cases and an incidence rate of fully 42.7 per 1000 in this population. (3) The data appear to indicate that the disease is rare in children at the age of two and under; that among both males and females up to twenty years the incidence is similar, being higher among children between two and ten years than in persons of the ages of ten to nineteen inclusive; and that among adults twenty to fifty-four years old the incidence is many times higher in females than in males. (4) There was a sharp rise in incidence during April and May, reaching a well-defined peak in June. The season of onset appeared to be confined almost entirely to the six months April to September inclusive. (5) The pellagra rate among both males and females was considerably higher for the non-millworkers than for the millworkers. (6) While

the pellagra rate among non-millworking females was approximately four times as high as that among millworking females, the rate for disabling sickness appeared distinctly higher in millworking than in non-millworking females. The disability indicated by the higher sickness rate among millworking females appeared not to influence materially the pellagra rate in this group."

A Study of the Relation of Factors of a Sanitary Character to Pellagra Incidence in Seven Cotton Mill Villages of South Carolina in 1916.—GOLDBERGER, WHEELER and SYDENSTRICKER (*Public Health Reports*, 1920, No. 29, xxxv, 1701) conclude the study of their problem as follows: "This study of the relation of factors of sanitary importance to the incidence of pellagra in seven representative mill villages has failed to reveal any consistent correlation between them. Although based on a rather small mass of data and, in itself, not warranting any conclusions, it may, nevertheless, be noted as not without significance that this result, at any rate, affords no support for the view until recently, at least, quite widely entertained in this country, that pellagra is 'an intestinal infection transmitted in much the same way as typhoid fever;' nor does the evidence adduced in favor of this view by other workers, when rightly considered, afford it any real support. It may be of interest to add that the results of the very much more extensive study of this subject carried on by us during 1917 and 1918, to be presented in a later communication, are in harmony with and confirm those here recorded."

Absorption of Cyanide Gas by Foodstuffs.—The Public Health Service (*Public Health Reports*, No. 27, xxxv, 1597) has had a series of experiments made to determine whether there is any danger of poisoning from the use of foodstuffs that have been exposed to cyanide gas in the process of fumigation for the destruction of vermin. The experiments were conducted by exposing bread and milk to the gas and then feeding the exposed food to mice, and, as a result of the tests, it was considered that the danger was "exceedingly remote."

Can the Mosquito Convey Infection from a Malaria Patient Undergoing Treatment? Does Sporogony Affect Mosquito Life?—MAYNE (*Public Health Reports*, No. 28, xxxv, 1664) reviews the evidence on this subject, which indicates that the gametocytes taken with the blood of a patient undergoing quinin treatment develop in the usual manner and that transmission to a new human host may occur. The infestation of the mosquito host does not appear to be prejudicial to the life of the insect; this is in contrast with the high mortality of mosquitoes infested with microfilarial parasites.

Utility of Antiplague Vaccines and Serums.—MCCOY and CHAPIN (*Public Health Reports*, No. 28. xxxv, 1647) review the evidence of the value of biologic products in the prophylaxis and treatment of plague. The work of Haffkine and others is reviewed and the opinion is expressed that while vaccine is probably of some value it is not capable of controlling an outbreak of plague. The evidence on the prophylactic value of serum is not conclusive and the agent need not be seriously con-

sidered in this connection. The therapeutic use of serum is usually advantageous but brilliant results are seldom seen. The concluding paragraph of the paper is as follows: "It seems rather unfortunate to those who are called on for advice in connection with a plague outbreak to find that popular and professional interest is so frequently centered on the subject of prophylaxis by vaccines or serums and on treatment by serum when, in fact, the situation demands active measures against rodents. Under American conditions at least it is not a matter of much importance whether biological products are used in a prophylactic way or not. The health officer need give but little consideration to them in his plans to deal with an outbreak of bubonic plague. If people want to be vaccinated for prophylactic purposes there is no objection to complying, but the community should not be allowed to delude itself into the belief that plague may be controlled in this manner. The essential features of an antiplague campaign should be the extermination of rodents and not immunization by means of vaccines or serums."

Treatment of Leprosy, with Especial Reference to Some New Chaulmoogra Oil Derivatives.—McDONALD and DEAN (*Public Health Reports* No. 34, xxxv, 1959) take a most optimistic view of the prospects of cure in the treatment of leprosy by means of the ethyl esters of the fatty acids found in chaulmoogra oil. Their conclusions are as follows: (1) The intramuscular injection of the ethyl esters of the fatty acids of chaulmoogra oil usually leads to a rapid improvement in the clinical symptoms of leprosy. In many cases the lesions disappear, except for scars and permanent injuries, and the leprosy bacillus can no longer be demonstrated. (2) When combined with iodine, the fatty acids of chaulmoogre oil and their esters give good results; but there is no adequate experimental proof that this addition of iodine causes any increase in the effectiveness of the materials used. (3) All of the available evidence obtained from the use of fractions of the fatty acids of chaulmoogra oil indicates that the therapeutic action is due to one or more of the fatty acids of the oil or to some as yet unidentified substance associated therewith. The various methods of fractionation heretofore employed have failed to demonstrate the active agent. (4) Although conclusive evidence is not at hand, it is probable that the oral administration of chaulmoogra oil derivatives is of minor importance compared with the injections. (5) In treating leprosy, it is important to make use of all auxiliary agencies to build up and maintain bodily vigor. (6) Hypodermic injections of the ethyl esters into leprous nodules are followed by marked swelling with ultimate recession of the lesions. This is a valuable auxiliary treatment for especially resistant lesions.

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Not quite twelve years ago Mackenzie published his epoch-making work on *Diseases of the Heart*, which marked the beginning of a revolution in our knowledge of the physiology and pathology of that important organ. At about the same time Einthoven brought forth his string galvanometer as a clinical instrument for the scientific study of the mechanism of the heart-beat; and through the work of Mackenzie the polygraph had become an instrument of great clinical value. We were thus, all at once, provided with a new outlook upon the functions of the heart in health and disease and with instruments of precision for the study of these functions. During this brief span of years our knowledge of the heart's normal and pathologic physiology has been advanced far more than it had in the preceding century, and with this advance there came the opportunity for the more accurate investigation of the action of drugs upon the heart in man. Many such investigations have been made with reference to the actions of digitalis and the digitalis bodies, and it is with the results of some of these that the present paper is concerned.

Slowing of the heart has been regarded as one of the characteristic actions of digitalis in man ever since it was first observed by Withering. The most superficial observation should have revealed

* Read before the College of Physicians of Philadelphia, April 7, 1920.

that this action often fails to appear even when the administration of digitalis is followed by beneficial effects. We now know that the only large group of cases in which digitalis produces marked reduction in the heart-rate is that of auricular fibrillation. With but two exceptions the therapeutic administration of digitalis is seldom followed by a significant degree of slowing of the heart-rate in the presence of the normal sinus rhythm. The two exceptions are those cases of heart-failure in which marked edema is present and those with hypodynamic, unstable hearts in which the rate is generally rapid but is subject to spontaneous fluctuations. In both of these digitalis generally produces considerable slowing. Finally, slowing of the heart is seen in man not infrequently as one of the common manifestations of digitalis intoxication, when it is due to the production of some degree of heart-block. When the normal sinus rhythm is present, therefore, slowing cannot be regarded as one of the primary characteristic therapeutic actions of digitalis. The recognition of this fact is of considerable therapeutic importance, for it reveals the fallacy of one of the chief objections advanced against the administration of digitalis in cases of heart failure due to aortic insufficiency, and recent clinical experience has shown that digitalis is not only not contra-indicated in such cases but is often of great value for the relief of the failure. It should be said, however, in this connection that heart-failure does not usually result from aortic insufficiency until a late stage, when the contractile power of the ventricular musculature has been greatly exhausted. Therefore, while digitalis is not contra-indicated its administration not infrequently fails to relieve the heart-failure. There is no satisfactory evidence, however, that its judicious employment is ever harmful in such cases, and it should always be given a trial.

The mechanism by which digitalis produces slowing of the heart has been the subject of recent investigation, especially by Cushny, Marris and Silberberg,[1] Cushny[2] and others. It has long been known, as demonstrated in animal experiments, that digitalis stimulates the vagus center in the medulla and thereby reduces the rate of the heart in one of two ways: Either the rate of the whole heart is diminished by depression of the rate of impulse formation in the sinus or the rate of the ventricles alone is reduced through depression of auriculoventricular conduction to a degree sufficient to cause partial or complete heart-block. The former, slowing of the whole heart, is the type commonly found in patients presenting the normal sinus rhythm—that is, in patients with the hypodynamic heart and in those with edema. The latter, as has been mentioned, is commonly a manifestation of minor intoxication by digitalis, and also occurs chiefly in hearts with the normal rhythm.

[1] Action of Digitalis in Therapeutics, Heart, 1912–13, iv, 33.
[2] Digitalis in Auricular Fibrillation, Jour. Pharm. and Exp. Therap., 1918, ii, 103

It has been said that digitalis is contra-indicated in cases of partial heart-block, and in those in which there is evidence of impaired conduction, as shown by prolongation of the *A–V* or *P–R* intervals. It has also been stated that marked prolongation of conduction time and partial heart-block occur in man from the use of digitalis only in cases previously showing some impairment of conduction. Neither of these contentions is wholly correct. Extensive clinical observations have shown conclusively that while there is an increased tendency for digitalis to enhance a preëxisting depression of conduction or partial block it is by no means contra-indicated in cases of this type. In many such cases it may be administered with satisfactory results without further prolongation of conduction time or increase in heart-block. In others the block, or impaired conduction, seems to be largely secondary to the existence of the heart-failure, and when digitalis relieves the failure the block may disappear or the conduction time may be shortened. Finally, if the administration of digitalis does show a tendency to increase an existing impairment of conduction this can generally be overcome by the administration of suitable doses of atropin to depress the cardiac endings of the vagus and thereby remove the effects of the central stimulation. While digitalis is not contra-indicated in cases with impaired conduction it should always be administered with caution and the patient should be observed at frequent intervals, always with the aid of instrumental methods if possible, to detect at once any increased depression of conduction should it develop.

The belief that therapeutic doses of digitalis do not frequently depress conduction in man unless there is an existent impairment of this function has been overthrown by Cohn[3] and by White and Sattler,[4] who have shown that some delay in conduction time is an almost invariable phenomenon of digitalis action even in normal persons. It is true, however, that the depression is not usually very marked until the stage of minor digitalis intoxication is reached. The prolongation of conduction time may progress gradually during the administration of digitalis or it may develop suddenly. It seems quite probable that the delayed conduction may constitute an action of digitalis which is of some therapeutic value in cases in which the rate of the heart is not altered even though the delay be small. The interval between the auricular and the ventricular contractions is increased by the time by which conduction is prolonged, and even when this does not exceed 0.02 of a second it means a considerable increase in the time allowed for the auricles to empty into the ventricles. This should be quite sufficient to increase

[3] Clinical and Electrocardiographic Studies on the Action of Digitalis, Jour. Am. Med. Assn., 1915, lxv, 1527.

[4] Effect of Digitalis on the Normal Human Electrocardiogram, with Especial Reference to A–V Conduction, Jour. Exp. Med., 1916, xxiii, 613.

materially the amount of blood flowing into the ventricle, especially in cases of mitral stenosis, and thereby improve the circulation.

Recognition of the capacity of digitalis to depress auriculoventricular conduction through stimulation of the vagus center and the discovery of the fact that its striking capacity to slow the ventricular rate in auricular fibrillation is due to the blocking off from the ventricles of many of the feebler auricular impulses, led to the tacit assumption that this block was also dependent upon central vagus stimulation. Cushny and his associates, however, observed that the block produced in auricular fibrillation, unlike that in the regular heart, could not in many cases be abolished by depression of the vagus endings in the heart by atropin. That is, they found that before digitalis was given the administration of atropin produced a greater acceleration in ventricular rate than followed the same dose when given after the ventricles had been slowed by digitalis. They thereupon investigated the mechanism of the slowing produced by digitalis in man, in intact animals and in perfused, isolated animals' hearts, and concluded there are two types of mechanism by which this is accomplished. Type A is purely inhibitory through central vagal stimulation; it can be antagonized by paralysis of the vagus endings with atropin; and it is the mechanism commonly found in the presence of the normal sinus rhythm. Type B is the result of a direct action of digitalis on the conducting tissues to depress their functions; it is unaffected by atropin; and it is the mechanism involved in most cases of auricular fibrillation and in rare instances when the rhythm is normal. It occurs typically in animal hearts which have become malnourished by long perfusion, and Cushny suggests that it rests largely upon the existence of malnutrition. He believes that it is common in auricular fibrillation because that condition especially favors the development of malnutrition of the human heart.

The accuracy of Cushny's observations is not to be doubted, but we believe that his conclusions are too sweeping. In the first place Cushny's own observations do not seem to exclude all participation of the vagus inhibitory action, for while he shows that the administration of atropin produces a greater acceleration in ventricular rate, both actual and proportional, when the heart is not slowed by digitalis than when it is, his records also show that atropin does accelerate the rate even when it has been greatly slowed by digitalis. This seems to indicate the existence of some vagal inhibition, and his arguments to the contrary are not altogether convincing. Further, his contention that the slowing is produced by a direct action of digitalis upon the junctional conducting tissues does not seem to have been proved by his experiments, although the action is evidently upon some structure distal to the vagal endings. Cohn

and Fraser[5] have shown that even when the administration of atropin fails to restore the heart-rate to its previous level after it has been slowed by digitalis the atropin, nevertheless, always removes completely whatever delay in conduction the digitalis may have produced. The whole matter is in need of further investigation.

So much for the mechanism by which digitalis slows the human heart, let us now briefly consider the therapeutic value of reducing the rate of the ventricles or of the whole heart. We have already indicated how simple prolongation of conduction time may be of value in mitral stenosis. Reduction in the rate of the heart, or that of its ventricles, is accompanied by a lengthening of the diastolic or resting-phase of the ventricles, while the duration of the systolic-phase is but little altered. This lengthening of diastole allows a larger volume of blood to flow into the ventricles and gives time for a more complete recovery of their contractile power. The force and volume output of ventricular systole are thus increased, and since more blood is thrown into the aorta and diastole is prolonged, coronary circulation is increased, the nutrition of the ventricular musculature is improved and internal respiration is more perfect in the ventricles. These secondary results are especially pronounced in cases of auricular fibrillation because of the added fact of the elimination of the frequent abortive ventricular contractions which exhaust the contractile power and do not contribute materially to the nutrition of the ventricular musculature. It should be mentioned in this connection that while digitalis so effectively slows the ventricles in auricular fibrillation the rate and the fibrillation of the auricles are not altered.

While slowing alone can account for all of those beneficial effects of digitalis in man which lead to the restoration of the failing heart and secondarily to the disappearance of the patient's symptoms, it is far from being a constant effect. The contention that the beneficial effects of the administration of digitalis are wholly attributable to its capacity to slow the heart is not supported by the facts, for there are many cases in which digitalis is quite effective in restoring the failing heart, although it does not alter its rate. The experiments of Gottlieb and Magnus[6] and others, on the isolated perfused heart, demonstrate that digitalis is capable of producing a marked increase in the volume output of the ventricles per beat, both by increasing the extent of diastolic filling and the completeness of systolic emptying. They also show that the force of ventricular systole is markedly increased by digitalis. These actions are necessarily exerted directly upon the ventricular musculature, since they occur in the heart after its removal from the body. Francois-

[5] Certain Effects of Digitalis on the Heart, XVIIth Int. Cong. Med., 1913, Medicine.

[6] Digitalis und Herzarbeit, Arch. f. exp. Path. and Pharm., 1904, li, 30.

Frank observed similar results from the administration of digitalis to living animals. These experiments suggest the existence of a similar direct action of digitalis on the human heart to increase the force and volume of ventricular systole. Although there are no methods available for proving the existence of such an action in man, it seems highly probable that it does occur for the following reasons: In the first place the alterations in the T wave of the electrocardiogram, which Cohn, Fraser and Jamieson[7] have shown to occur commonly early in the course of the administration of digitalis to man, are apparently due to a direct action of the drug upon the myocardium. Cushny's observations previously discussed also seem to prove that digitalis exerts a considerable direct myocardial action in man, and there is every reason to believe that the production of ventricular premature contractions by digitalis is the result of a direct muscular action. There is evidence, therefore, that digitalis does act directly upon the human myocardium. In the second place we know that digitalis is capable of relieving heart-failure and restoring cardiac efficiency in cases in which it produces no slowing, and even in cases of complete heart-block. It is impossible to account satisfactorily for its effects in such cases except by assuming that it increases the force or magnitude, or both, of ventricular systole.

We have seen that digitalis may exert one or more of the following actions in man when administered in therapeutic doses:

1. It may slow the rate of the whole heart through stimulation of the vagus center.

2. It may prolong the time of auriculoventricular conduction through a similar action.

3. It may slow the rate of the ventricles, either by the production of some degree of heart-block through central vagal stimulation or by virtue of some direct action on the heart.

4. It seems probable that it may exert a direct action on the myocardium which results in an increase in the force or magnitude, or both, of ventricular systole.

These, and these alone, seem in the present state of our knowledge to be the primary therapeutic actions of digitalis, but their secondary results are limited only by the conditions existing in the given case of heart-failure. By them the failing heart is restored and the circulation of blood through the body is improved.[8] The blood is more perfectly ventilated in the lungs; stasis and congestion are overcome; dyspnea, orthopnea, cyanosis and cough diminish and finally disappear; edema and transudates are absorbed; diuresis is produced.

[7] Influence of Digitalis on the T-wave of the Human Electrocardiogram, Jour. Exp. Med., 1915, xxi, 593.

[8] Stewart, G. N., and Scott, R. W.: Change Produced in the Bloodflow (in the Hands) under the Influence of Digitalis in Cases of Auricular Fibrillation, Jour. Pharm. and Exp. Therap., 1915, vii, 263.

Before leaving the subject of the clinical pharmacology of digitalis a few matters demand brief discussion because they do not even yet seem to be clearly understood by all. The impression that the existence of a high systolic blood-pressure in a patient with heart-failure contra-indicates the administration of digitalis seems still to linger in the minds of many. The subject of the influence of digitalis on the blood-pressure in man was discussed a few years ago,[9] and it was shown that the vasoconstriction which could be demonstrated to occur in animals and in isolated surviving vessels under the influence of digitalis took place only when amounts of the drug were used which were far in excess of any which could possibly be given to man. It was shown that there is no evidence that either digitalis or digitoxin has any direct action on the bloodvessels when given to man even in large therapeutic doses. A large number of careful observations of the effects of the administration upon the blood-pressure in man were analyzed and it was found that the changes in the systolic and diastolic pressures are generally relatively slight, the tendency being for the pressures to be altered in the direction of the normal. There is a marked tendency for the pulse-pressure—the difference between the systolic and diastolic pressures—to increase under the influence of digitalis, chiefly through reduction of the diastolic pressure, in cases of heart-failure in which the failure is relieved. A decided fall in the systolic pressure is to be anticipated when digitalis relieves heart-failure in cases in which it is accompanied by a high systolic pressure and marked edema. There is also a marked tendency for digitalis to reduce the systolic pressure from its high level in cases with marked dyspnea, cyanosis and circulatory stasis. All of the facts, therefore, show conclusively that digitalis is not contra-indicated by the existence of high blood-pressure.

A closely related matter is that of the possible action of digitalis on the human coronary arteries. Of course, it is not feasible to detect such an action with certainty in man, yet some recent text-books state that, in toxic doses at least, digitalis may produce a dangerous constriction of the coronaries, and it has also been argued that when pulsus alternans is produced or aggravated by digitalis the phenomenon is due to coronary constriction. These beliefs have also been responsible for the view that digitalis is contra-indicated in cases with so-called angina pectoris. We are convinced that these ideas are misleading and erroneous: (1) The painstaking animal experiments of Felix Meyer[10] and of Sakai and Saneyoshi[11]

[9] Eggleston, Cary: Influence of Large Doses of Digitalis and Digitoxin on the Blood-pressure in Man, Jour. Am. Med. Assn., 1917, lxix, 951.

[10] Ueber die Wirkung verschiedener Arzneimittel auf die Coronargefaesse des lebenden Tieres, Arch. f. Anat. and Phys., phys. Abteil., 1912, 223.

[11] Ueber die Wirkung einiger Herzmittel auf die Koronargefaesse, Arch. exp. Path. and Pharm., 1914–15, lxxviii, 331.

and others have shown that the digitalis bodies do not constrict the coronaries of the heart *in situ*. In fact, digitalis seems to dilate them actively while strophanthin increases the coronary blood flow indirectly by elevation of the aortic pressure. (2) The statement that marked coronary constriction may occur in man from toxic doses of digitalis is based upon pure assumption and not upon any satisfactory evidence. (3) The occurrence or aggravation of pulsus alternans occasionally seen in cases of advanced heart failure under digitalis treatment does not prove that the drug is responsible for the change or that coronary constriction is present. Pulsus alternans may well develop spontaneously in such cases and in spite of the administration of digitalis rather than because of it. When alternans is already present it is strong evidence that the exhaustion of the heart is almost complete. and in such a heart the exhaustion may progress even when digitalis is being used in adequate doses for all forms of treatment frequently fail to check the progress of failure in such late stages of heart disease. (4) Digitalis is often of great value in cases with pulsus alternans and not infrequently restores the normal rhythm, at least temporarily.[12] (5) When the administration of digitalis results in the relief of heart-failure and the restoration of cardiac efficiency it is inconceivable that it should improve the capacity of the heart for work and at the same time reduce and impair its nutrition and internal respiration by a constriction of the coronaries. It is a fact also that anginal pain is usually but a symptom of heart-failure and the control of the failure by the administration of digitalis frequently relieves the pain. In such cases the continued or intermittent use of digitalis, by preventing the recurrence of failure, often also prevents the recurrence of the pain.

The third question upon which some doubt seems to persist is that of the mechanism of the diuretic action of digitalis. While it has been claimed that digitalis exerts a specific diuretic action on the kidneys, or that it produces diuresis by selective vasodilatation of the renal arterioles, the evidence for these claims is quite unsatisfactory, and careful studies have shown conclusively that the drug is not a diuretic in normal animals. It has also been observed repeatedly that no diuresis follows the administration of digitalis to normal human beings or to those with heart-failure uncomplicated with edema or serous effusions. In cases of nephritis with edema, or even with general anasarca, digitalis also produces no diuresis when heart-failure is not associated with the nephritis. When, however, heart-failure is accompanied with edema or anasarca profuse diuresis may follow the administration of digitalis, but this is found to occur only when the heart-failure is more or less effectively

[12] Windle, J. D.: Clinical Observations on the Effect of Digitalis in Heart Disease with Pulsus Alternans, Quart. Jour. Med., 1916–17, x, 274.

overcome by the drug, and when the heart failure is not affected no diuresis ensues from its administration. It is clear, then, that the diuretic action of digitalis in man is essentially secondary to its capacity to relieve heart-failure and restore the circulation; and when it is effective in edematous cases of heart-failure, it is often one of the earliest of the manifestations of the action of the drug, though other evidences can be detected if looked for. When adequate digitalization fails to produce diuresis in a patient with edema and heart-failure it will almost invariably be found that either the heart-failure has not been relieved or that the failure is complicated by nephritis, which then demands appropriate treatment.

Having reviewed some of the more important therapeutic actions of digitalis, let us now turn to the consideration of certain of the problems connected with its oral administration to man. In approaching these questions we must bear in mind the following points:

1. The indication for the administration of digitalis is determined by the degree of heart-failure, not by the cause of the failure.

2. The dosage and the criteria of the action of digitalis are identical, irrespective of the cause of the heart-failure, although the method of administration may be influenced by the cause of the failure.

3. In the absence of satisfactory therapeutic response one can be certain that digitalis has been given a fair trial only when it has been administered to the point of production of one or more of the criteria of minor intoxication.

The proper administration of digitalis demands the ability to judge the degree of digitalization which is being produced because all of the digitalis bodies can cause serious poisoning and because the nature of heart-failure is such that incomplete recovery or death may result from inadequate treatment. The following are the more important criteria by which the degree of digitalization can be judged:

In cases which respond favorably there is a group of phenomena, both subjective and objective, which indicate more or less effective digitalization and which may be embraced by the term, "Clinical Improvement." These include all such definite evidences of improvement in the circulation as relief or disappearance of the patient's respiratory symptoms; relief of cardiac or precordial pain; disappearance of the nausea due to splanchnic congestion; the production of diuresis; diminution or disappearance of evidences of congestion of the liver; fall in pulse-rate; decreased degree of irregularity in auricular fibrillation together with reduction in the pulse deficit, or its disappearance.

The number and nature of these phenomena and the extent

of their development depend on the conditions existing prior to treatment, on the capacity of the heart to respond to digitalis and on the adequacy of treatment. When well-developed they usually indicate adequate digitalization and the discontinuance of the drug or a reduction in its dose. Their occurrence also corresponds in the majority of cases to the appearance of minor toxic actions of digitalis.

The following phenomena occur independently of a therapeutic response and are not necessarily indicative of a toxic action of digitalis, though each is certain evidence of the absorption and action of the drug: Prolongation of the time of auriculoventricular conduction, which can be detected in graphic records as one of the earliest and most constant effects of digitalis upon the heart; flattening or inversion of the *T* wave of the electrocardiogram, which is nearly as constant as the preceding but does not occur quite so early; the production of sinus arrhythmia or the exaggeration of a preëxisting sinus arrhythmia.

Finally, the following phenomena are indicative of some degree of digitalis intoxication and their appearance demands the cessation of further administration or a sharp reduction in the dose: Nausea or vomiting; marked grade of sinus arrhythmia, especially when phasic in type and independent of respiration; partial or complete heart-block; premature contractions; the "coupled rhythm" due to the regular recurrence of a premature contraction after each regular beat; auriculoventricular dissociation; the *A–V* or nodal rhythm; ventricular tachycardia; other rare disturbances of the cardiac rhythm. Two or more of these phenomena not infrequently occur together in the same patient.

These arrhythmias of digitalis intoxication must be distinguished from those due to the heart-failure itself. This can frequently be accomplished only as the result of the most careful and constant observation of the patient from the outset, usually with the aid of graphic records, for it is impossible to distinguish without knowledge of the previous condition whether block, premature contractions, etc., are due to digitalis or to the progress of the heart-failure. In cases of advanced heart-failure in which the administration of digitalis must always be carried to the limits of the patient's tolerance when the desired therapeutic effects are not obtained, the knowledge and skill of the clinician are frequently taxed to the limit to determine when to stop the administration of the drug. In all such cases it is best to secure the aid of a specialist, preferably from the beginning, but always before it is too late for his services to be of value.

While it is generally desirable in the treatment of heart-failure to secure the maximal therapeutic effects of digitalis promptly the urgency of the symptoms and various other factors must determine the rapidity with which digitalization should be induced in any

given patient. With this in mind, and in view of the facts already set forth, three general plans of dosage by oral administration are suggested.

Small Dose Method. From four to six days are generally required for digitalization by this method; $\frac{1}{6}$ to $\frac{1}{4}$ gram (gr. ij to gr. iv) of the powdered leaf or $1\frac{1}{2}$ to $2\frac{1}{2}$ c.c. (♏ xx to ♏ xl) of the tincture should be administered every four hours—four doses daily—and continued until digitalization is induced. With weak or poorly absorbed specimens of digitalis full digitalization may not be secured at all by this method or it may require ten days or more to secure it.

Large Dose Method. From one to two days are required for digitalization. During the first twenty-four hours a dose of $\frac{4}{10}$ gram (gr. vj to gr. vij) of the powdered leaf or 4 c.c. (dram j) of the tincture should be administered every six hours, day and night, for four doses. On the second day the dose should be reduced one-half and the interval may be shortened to four hours, giving four doses per day and none at night. This latter dose and interval should be continued until full digitalization is secured.

The Body Weight Method. This method permits full digitalization within ten to twenty hours from the beginning of administration and is specially serviceable in cases manifesting urgent symptoms. Its use has proved so satisfactory during the five years that have elapsed since its introduction that it has been possible very largely to do away with the necessity for the intravenous or intramuscular administration of ouabain, strophanthin or other digitalis preparation. It has been described in detail so recently that it is sufficient to refer to some of the published papers in which it is discussed.[13] [14] [15] [16]

Mention of other members of the digitalis group of drugs has been omitted in discussing dosage by oral administration, because digitalis itself is preëminently the drug of choice by reason of its availability, absorbability and persistence of action. Its availability needs no comment but a few remarks are in place with reference to the choice of preparation. The preparation selected should always be one which has been assayed biologically and proved to be of high activity. It should be remembered, however, that the biologic unit is a more or less arbitrary figure which merely serves to indicate the relative activity of the preparation, as determined by a particular method of assay, and in general it bears no direct relation to the dose

[13] Eggleston, Cary: Digitalis Dosage, Arch. Int. Med., 1916, xvi, 1.

[14] White, S. M., and Morris, R. E.: Eggleston Method of Administering Digitalis, Arch. Int. Med., 1918, xxi, 740.

[15] Robinson, G. C.: Rapidity and Persistence of the Action of Digitalis on Hearts showing Auricular Fibrillation, Am. Jour. Med. Sc., 1920, clix, 121.

[16] Eggleston, Cary: Administration of Digitalis by the "Eggleston Method," Jour. Am. Med. Assn., 1920, lxxiv, 733.

of the preparation for man. The cat unit, however, is employed for the calculation of the human dose in the Body Weight method of administration. The figures obtained by different methods of bio-assay are not comparable one with another, but it is generally true that a preparation which is highly active, as shown by one method, will be found active by any other, although the activity of a given specimen may differ considerably by different methods of assay.

The particular official form of digitalis selected will depend largely upon the personal preference of the physician, but we are convinced that the powdered leaf and the tincture are the most satisfactory. The dose of each is of convenient bulk; each can be assayed biologically and each keeps for long periods of time without material loss of activity. The powdered leaf is especially to be commended because it can be dispensed in capsules, which are easily carried and pleasant to take, and the disagreeable bitter taste of the fluid preparations is avoided. The dose of the fluidextract is too small for convenience, while that of the infusion is unnecessarily large, in view of its unpleasant flavor. Further the fluidextract is seldom up to standard in activity and the infusion is not assayed. Even when the infusion is prepared from the assayed leaf the activity of different lots is seldom uniform on account of variations in the completeness of extraction of the active constituents.

Of the many proprietary preparations and specialties which are offered with high claims for oral administration none is superior to the powdered leaf or tincture of high grade, and most are decidedly inferior. All are quite costly and the price of some is exorbitant. If one feels impelled to employ one of these, digipuratum or digipoten will be found to be the best, but these are merely carefully assayed, purified preparations from good digitalis leaves.

The materia medica of the digitalis group of drugs is large, but digitalis alone is well absorbed from the alimentary tract of man. Strophanthus, convallaria, squills, etc., are both poorly and irregularly absorbed. Strophanthus deserves special mention, because it is 100 times as active as digitalis, yet the official dose is only half that of digitalis, and it is often given in equal doses. The irregularity of its absorption is of greater importance than the fact that its absorption is generally poor, for in some cases serious poisoning has resulted from the rapid absorption of the customary dose.[17] We are convinced that strophanthus should never be used for oral administration to man on account of the danger of serious accident, despite the fact that it often has been so used with satisfactory results.

The subjects of absorption, persistence of action and elimination of digitalis are so closely related that we will discuss them together

[17] Hatcher, R. A., and Bailey H. C.: Clinical Use of Strophanthus, Jour. Am. Med. Assn., 1910, lv, 1697.

in the closing section of this discourse. While digitalis is generally well-absorbed from the human alimentary canal, several instances have come to our attention in which absorption was very unsatisfactory.[18] In some instances the poor absorption is unquestionably due to some individual peculiarity on the part of the patient or to some factor in his condition. In others, however, the fault seems to lie with the digitalis, and my colleague, Dr. Robert A. Hatcher, has been able to throw some light on this matter. His work has not yet been published and is still incomplete, but the following observations seem highly significant: Digitalis can be readily separated into two fractions by extraction of its aqueous solution with chloroform. The chloroform-soluble fraction is readily absorbed from the alimentary tract of the cat, while the chloroform-insoluble fraction is poorly and irregularly absorbed. Both fractions are active when injected intravenously, manifesting the typical actions of digitalis. The two fractions vary widely in the relative proportions in which they are present in different samples of digitalis, and at least one of the samples of digitalis which showed very poor absorption in man contained relatively very little of the chloroform-soluble, absorbable fraction.

Dr. Hatcher has supplied me with solutions of these two fractions, of equal activity by the cat test, and these have been administered to a number of patients to observe their absorption. These observations, too, are incomplete, but they have shown quite definitely that the chloroform-soluble fraction is well absorbed from the human alimentary tract while the chloroform-insoluble fraction is absorbed poorly. Comparing the amounts required to produce minor intoxication or full therapeutic effects, nearly four times as much of the chloroform-insoluble fraction as of the chloroform-soluble is required to produce similar effects. This is true even when the two fractions are given on different occasions to the same patient. The rate of absorption of the chloroform-soluble fraction seems to be quite equal to that of the best digitalis, but we do not yet know that it is any more rapid. The results of these observations will be reported in detail at a later time.[19]

It has been shown that digitalis of high grade is generally well absorbed from the digestive tract of man, and it seems apparent that the absorption of a single dose is completed within six hours. Recently, Pardee (unpublished) has shown that there is definite electrocardiographic evidence of considerable absorption in from two to four hours, and the observations of Levy (unpublished) and

[18] Wedd, A. M.: Observations on the Clinical Pharmacology of Digitalis, Bull. Johns Hopkins Hosp., 1919, xxx, 131.

[19] Since this was written two preliminary papers have appeared on this work: Hatcher, Robert A., Some Observation on the Pharmacology of a Digitalis Body, Jour. Am. Med. Assn., 1920, lxxv, 460. Eggleston, Cary, The Absorption of a Digitalis Body, Jour. Am. Med. Assn., 1920, lxxv, 463.

of Robinson[20] confirm this. These observations are quite at variance with the rather general belief that digitalis is slowly absorbed. That belief seems to have been based on the older mistaken idea that from three to six days were always required to secure digitalization in man, which, in turn, arose from the administration of single doses which were too small. We know now that digitalis is fairly rapidly absorbed and that full digitalization can be secured by oral administration certainly within twenty-four hours after the first dose, and frequently within ten hours.

Through the work of Hatcher[21] on animals and of Eggleston,[22] Cohn and his associates, Robinson and others, on man, it has been proved that the action of digitalis on the human heart may persist for periods up to two weeks or longer after administration has been stopped. This persistence of action is one of the valuable features of digitalis as a cardiac remedy and its recognition is of considerable therapeutic importance. In the first place it accounts for the phenomenon previously called "cumulation," and always somewhat shrouded in mystery. Taken together with the knowledge of the rate of absorption of digitalis, and of its average dose for man, it demonstrates the fact that it is quite unnecessary to administer digitalis at the short intervals customarily observed. It is never necessary to administer a dose more often than every four hours, and a six-hour interval is generally preferable. Further, when a patient is to be kept upon the continuous administration of a small dose of digitalis this need be taken only once daily instead of being divided into two or three doses. Finally, the persistence of action must always be kept in mind when one considers the administration of ouabain (crystalline strophanthin) or amorphous strophanthin intravenously or intramuscularly, for the doses of the latter are commonly large, in terms of activity, and serious or fatal poisoning has occurred from such injections in patients who have recently been receiving digitalis.

The mechanism of this persistent action is not definitely understood, but the evidence seems to indicate that it is due to the firm fixation of a small amount of the drug in the tissues of the heart where it continues to exert its actions. One of the strongest reasons for believing this to be the case is the fact that digitalis disappears from the blood stream very rapidly after intravenous injection in a variety of animals. Some earlier pharmacologic experiments also seem to indicate that the heart is capable of storing minute quantities of the digitalis bodies.

Very recently Pardee[23] has studied the rate of the elimination

[20] Loc. cit.

[21] Persistence of the Action of the Digitalins, Arch. Int. Med., 1912, x, 268.

[22] Clinical Observations on the Duration of Digitalis Action, Jour. Am. Med. Assn., 1912, lix, 1352.

[23] Notes on Digitalis Medication, Jour. Am. Med. Assn., 1919, lxxiii, 1822.

of digitalis in man by administering the drug orally until a definite effect was produced and determining the dose required. After a lapse of an interval during which no digitalis was administered the same preparation was again given and the amount determined which was required to reinduce the effect previously produced, In this way, using a single sample of tincture of digitalis, he determined that the rate of elimination amounted to about twenty-two minims per day. This figure, of course, applies only to the particular specimen of digitalis with which he worked, but it is significant and agrees with the general impression that from 1½ to 2 grains of digitalis (15 to 20 minims of the tincture) can generally be administered over long periods of time to prevent the recurrence of heart-failure, and without producing intoxication.

Finally, in closing, let me refer briefly to the investigations of Hatcher and Eggleston[24] on the elimination of certain digitalis bodies from the animal organism, since they throw some light on the mechanism by which elimination is accomplished. Their investigations show that in animals at least both the liver and the kidneys participate. The liver seems to be capable of rapidly fixing, and probably also of destroying or decomposing, a large proportion of ouabain after its entrance into the blood stream. Other tissues in the body also apparently can fix rapidly and thereby remove from the blood stream large amounts of ouabain, but the liver seems to be the organ chiefly concerned in the elimination. The part played by the kidneys is normally relatively insignificant. Whether or not these are the mechanisms involved in man is not known, and at the present time there seems to be no method of attacking the problem in the human being.

ROENTGENOLOGICAL ASPECTS OF LOWER RIGHT QUADRANT LESIONS.[1]

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The diagnosis of lower right quadrant lesions is a matter of great importance; not only is this because of the frequent occurrence of appendicitis, but because of other lesions which are apt to present

[24] Studies in the Elimination of Certain of the Digitalis Bodies from the Animal Organism, Jour. Pharm. and Exp. Therap., 1919, xii, 405.

[1] Read at the meeting of the American Gastro-enterological Association, Atlantic City, May 3, 1920.

themselves in this region, the differential diagnosis of which is often fraught with much difficulty.

Among the affections most frequently observed in the lower right quadrant of the abdomen may be mentioned:

1. Appendicitis.
2. Incompetent ileocecal valve and ileal stasis.
3. Dilatation of the cecum with retention.
4. Adhesions and angulations.
5. Ulcerations due to tuberculosis.
6. Ulcerations due to carcinoma.

In the roentgen-ray study of lower right quadrant lesions both bismuth meals and bismuth enemata must be employed When the bismuth meal is taken it ordinarily reaches the cecum in five to eight hours, according to the character of the meal, and the transverse colon in twelve hours. Delay in the passage of the bismuth may be due to a dilatation of the cecum, to ptosis or to adhesions, to ileal stasis and angulation; ulcerations or carcinoma. The bismuth enemata supplement the information obtained by the meal. These consist of 5 ounces of bismuth subcarbonate to the liter of water, to which sufficient mucilage of acacia is added to suspend the bismuth. The patient is placed in the knee-chest position, and the low enema is allowed to run in slowly by gravity. This method of examination is especially useful not only in determining lesions of the lower bowel but also of the lower right quadrant.

1. **Appendicitis.** *Acute Appendicitis.* Pfahler has called attention to the diagnostic value of the roentgen ray in acute appendicitis in certain instances, in that in those cases in which symptoms of acute appendicitis appear, due to beginning pneumonia in the lower right lobe, the lesion can be demonstrated in the lung, thus differentiating pneumonia from appendicitis, and that by filling the colon and thus determining the area of acute tenderness acute appendicitis may be differentiated from other acute lesions in the lower right quadrant.

Chronic Appendicitis. A roentgen-ray examination of the appendix itself in its chronic state is capable of rendering valuable service in many instances. This, of course, only applies to those cases in which the lumen is patent, while in the very chronic forms the lumen of the appendix may be completely closed as a result of an obliterative process and consequently the bismuth will fail to enter and the appendix naturally cannot be visualized. Case recommends a special technic for the examination of the appendix, and emphasizes two points: (1) The necessity of examining the patient in a horizontal position, with the screen over the abdomen and the tube underneath the table; (2) the necessity of palpating the abdomen under the screen with the gloved finger or preferably with a wooden spoon and noting the localized tenderness. The time of the examination is of some importance. In six hours usually the

cecum is fairly filled, and at that time the appendix under palpation will also probably fill. From this time on until the bowels are empty and frequently for some time afterward the appendix remains visible. The ordinary technic will frequently not show the appendix, so that we must first find the appendix fluoroscopically and make a roentgenogram in the position in which the appendix is visible. When the appendix remains visible for more than a day or two after the bismuth examination it is, in proportion to its poor drainage, a dangerous appendix. There are certain instances in which the bismuth shadow may persist for days, and in one or two instances it has been seen for weeks after the bismuth examination.

When visualizing the appendix the tenderness can often be localized immediately over it, and if the appendix be moved by the hand or spoon the tenderness will move with it. When the appendix is retrocecal the cecum must be pushed aside to visualize the appendix. A great majority of these retrocecal appendices show tenderness upon direct palpation. In those cases in which there is no tenderness appendicitis may usually be excluded, but if the cecum is adherent there is always a possibility that this is due to some inflammation of the appendix in the past even if the appendix is visualized and not tender. Pfahler claims that if there is localized tenderness over a fixed cecum, even if the appendix is not visualized, it means a pathologic appendix. The frequency of the visualization of the appendix by means of the bismuth meal is a much disputed point, varying according to several authorities from 35 to 90 per cent. The writers, however, do not believe every visualized appendix is necessarily pathologic. An appendix can be frequently found well-filled with bismuth, yet lying perfectly free, no signs of adhesions and the appendix emptying with the emptying of the cecum. Under certain conditions it seems there is no reason why the appendix should not fill without being pathologic. On the other hand, when we find an appendix filled with bismuth, curled up and fixed, this invariably means some pathologic process is present. When chronically inflamed an appendix is frequently adherent to the structures surrounding it. It may be fixed throughout its length or only partially so. It is a frequent occurrence to find the tip fixed with the body of the appendix lying free. If the appendix be palpated under these conditions the tenderness would indicate the presence of the chronic inflammatory process. The kinking of the appendix, which remains constant, is, according to Pfahler, a significant sign of adhesions; and when the appendix constantly points upward toward the gall-bladder region there is good ground to believe it to be in a pathologic state. The writers' experiences in this particular case agree with the findings of Pfahler. Attention has been called to the fact that in cases of chronic appendicitis, when studied fluoroscopically and radiographically, the pyloric end of the stomach is frequently observed to be lying down in the

lower right quadrant region. This is not due to adhesions but probably to the omentum wandering toward the inflammatory process. In such instances the stomach, when viewed under the fluoroscopic screen, can be moved to its normal position and yet will immediately upon release of the hand return to the lower right quadrant region. The reason for this abnormal position cannot be explained, but is probably due to some chemotactic attraction, and when present is a very definite indication of a pathologic appendix. At times, however, this position is due to adhesions from the appendix extending into the omentum, thus actually causing the stomach to be adherent in that position. We have frequently pointed out how partial obstructions of the pylorus due to inflammatory conditions are liable to lead to the production of adhesions extending to the lower right quadrant region, dragging the stomach in that direction, and thus the appendix may become secondarily affected. Adhesions associated with the appendix may, however, extend to the surrounding structures and may lead to varying degrees of cecal and ileal stasis, and even to partial colonic obstruction. While the roentgen ray renders valuable service in the diagnosis in many instances of chronic appendicitis there are a certain number of cases in which it does not demonstrate the condition or where its results may be misleading. This may be due to the fact that on account of its unusual position the appendix cannot be visualized or that its lumen is closed, due to an obliterative process, or for some reason the bismuth is prevented from entering, or there may be an absence of tenderness, especially between attacks. Both Carmen and Case have called attention to the fact that although retention of the bismuth in the appendix in plates does not necessarily always point toward a pathologic condition, yet on the other hand the appendix may be markedly diseased without being visible in the plates. In cases of subacute appendicitis, on account of the inflamed state of the appendix, the meal frequently will not enter, and there may be no adhesions. Fluoroscopically and radiographically nothing abnormal can be demonstrated in this region. The only sign that can be elicited will be tenderness over the appendix region. This tenderness, however, is also seen in a chronically distended cecum, and consequently it is not always a diagnostic sign referring to the appendix alone.

Attention must also be called to a patent source of error which should always be borne in mind. As a reflex condition a chronic appendicitis may give rise to a picture somewhat similar to that observed in duodenal ulcer; that is, there is gastric and duodenal hypermotility, with a definite filling defect and deformity of the duodenal cap; if this picture is rather marked and the appendicular adhesions are slight, one can understand how a chronic appendicitis might be mistaken for a duodenal ulcer, and in fact this error is sometimes made. In instances of this kind the plates must be most

carefully studied, repeated examinations made if necessary and in most instances a combined fluoroscopic examination, study of the plates, together with the clinical history, will point to the correct diagnosis; but even at times after a most careful investigation in every direction the correct diagnosis may still remain in doubt.

2. Incompetent Ileocecal Valve and Ileal Stasis. This condition is usually indicated by the fact that at the end of twenty-four hours after a bismuth meal the ileum is entirely empty, and yet at the end of thirty-six to forty-eight hours the terminal ileum is filled, indicating the presence of regurgitation from the cecum to the ileum, due to an incompetent ileocecal valve. According to Case, in about one-sixth of three thousand persons examined, most of whom were constipated and all affected with gastro-intestinal disturbances, the bismuth enema passed the iliocecal valve and filled the terminal ileum for certain distances. The ileocecal valve is normally competent and evidence of incompetency of this valve is indicated by the reflux of the bismuth meal from the colon into the ileum. Case insists that roentgenoscopic examination for this purpose must be conducted with the patient horizontal so that accurate visualized palpation may be practised under the fluorescent screen. Not infrequently, by means of massage in the antiperistaltic direction, bismuth may be forced back into the ileum from the cecum, which indicates marked incompetency.

His method of testing the competency of the valve is the following: "The patient should lie supine on the horizontal fluoroscopic table. It is not necessary to introduce the rectal point or colon tube more than one or two inches. The container should be placed not higher than two feet above the patient and the barium or bismuth enema allowed to flow by gravity, the course of the bismuth column being watched fluoroscopically. Ordinarily 1200 c.c. of the barium enema at 100° F. will suffice to fill the colon. It is important that a uniform technic be followed. I insist on seeing, by means of the fluoroscope, that the cecum is well filled. Massage of the abdomen over the shadow of the cecum is practised in the antiperistaltic direction. Still further to ensure complete filling of the cecum the patient is sometimes asked to lie on the right side for ten to fifteen minutes after the injection of bismuth, and a second examination is made when the patient returns to the table after evacuating the colon. The roentgenograms are made with the patient lying prone, plate anterior, rather than lying supine, plate anterior. In the latter position 'saddling' of the ileum over the ileopectineal line may lead to a confusion. In marked cases of ileocolic valve insufficiency, however, there is never any difficulty in recognizing the terminal ileum." When the bismuth meal is taken it collects in about four hours in the ileum, while within eight or nine hours the ileum is normally empty of its contents. Delay in its passage may be occasioned by spasm, incompetency of the ileocecal valve, bands

of adhesions, displacements, prolapse or tumors; dilatation of the terminal portion of the ileum points to obstruction. In the study of ileal stasis care should be exercised to determine the emptying time of the stomach, inasmuch as any delay in the evacuation of the stomach may prevent the meal from reaching the ileum. When the bismuth is given by mouth and we find an actual regurgitation of the bismuth from the cecum back into the ileum, we are probably dealing with a true incompetency of the iliocecal valve. Incompetency, however, may be produced by means of the bismuth enemata if the enema is put in under too much pressure. When this is done, extremely violent antiperistaltic waves are set up which force the bismuth through the valve. The writers have repeatedly failed to demonstrate this incompetency by the bismuth meal and yet incompetency could be produced by giving the enema under forced pressure, so that one must be very careful in drawing conclusions when the examination is made by means of enemata.

3. Dilatation of the Cecum with Retention. When the bismuth meal is taken it ordinarily reaches the cecum in from seven to ten hours. Delay in the passage of the bismuth may be due to dilatation and retention in the cecum, which can easily be discovered by means of the roentgen ray. The cecal stasis may in some instances be associated with a chronic appendicitis, and both may, as Brown has pointed out, be due to high degrees of enteroptosis as a result of a secondary low-grade inflammatory process. The degree of cecal stasis may vary markedly in various individuals, twenty-four or even forty-eight hour retention not being unusual in some individuals. While the roentgen ray points out clearly the location of the cecum and colon, yet ptosis is a question of minor importance; similarly the position of adhesions and membrane attachments only play an important role insofar as they may lead to an interference with the function of the bowel. It is not the position of the cecum and colon with which we are most concerned but the functioning of this portion of the digestive tract, for directly in proportion to disturbances of function are symptoms of retention and partial obstruction produced.

The roentgen-ray examination of the dilated cecum has probably thrown more light upon this type of constipation than we have heretofore had. It is interesting to note that with a dilated cecum the patient may frequently not complain of constipation, on the contrary, state that the bowels move regularly every day. Yet in these cases one will find that a large part of the bismuth will remain in the cecum from forty-eight to one hundred and twenty hours. The bismuth will become almost adherent in masses to the sides of the cecum and allowing only a small channel in the center. In some of the most obstinate cases when the cecum has been explored these fecal masses are so adherent to the walls that when removed there is sometimes bleeding of the mucous membrane beneath. This must

of necessity cause a low grade of inflammation of the cecum which will frequently extend to the appendix. In such cases on operation when a chronically inflamed appendix is found, one must remember the primary cause is not in the appendix but in the cecum, and the removal of the appendix will not be of benefit to the patient.

Wilms has described a condition affecting the cecum known as mobile cecum, which is a movable atonic cecum. But little attention is now attached to this condition, for here too change in position plays but a very insignificant role; it is the adherent fixed cecum which is the seat of stasis and which is productive of symptoms.

By means of the roentgen ray and screen we are able to determine the presence of adhesions surrounding the cecum, the position of such adhesions and how far these interfere with the motility of the bowel. Important advantages are frequently obtained by means of the fluoroscopic method in the study of the cecum and its surrounding structures. By means of palpation under the fluorescent screen many important conditions may be noted. It is by this method of examination that the identification of various areas of pain on pressure, the question of motility, and separation of loops of intestines surrounding the cecum may be observed.

4. Adhesions and Angulations. Attention has already been called to the angulations and kinks which may occur to the lower right quadrant due to adhesions and which are usually readily recognized by means of the roentgen-ray. The adhesions may not, however, be limited to the appendix but may be associated with the cecum, at times causing marked fixation of this portion of the intestine, or may even be connected with the ascending colon or the ileum causing various degrees of obstruction, or may be due to pelvic inflammatory conditions producing a similar effect. In fact, the terminal portion of the ileum is a common seat for adhesions. On operation one frequently finds in cases of chronic appendicitis that the appendix itself is perfectly free and no adhesions are observed around the cecum, but the terminal ileum appears fixed and frequently kinked, so that the ileum beneath the kink becomes dilated and at times almost obstructed.

All of these conditions can be easily detected by the delay in the passage of the bismuth, which will be revealed in the plates, and by means of the fluoroscope.

Inasmuch as adhesions are detected by changes and delays in motility, great care must be exercised in drawing conclusions regarding these findings.

5. Tuberculous Ulcerations. Brown and Sampson call attention to the importance of the roentgen ray in the diagnosis of intestinal tuberculosis. According to these authors the clinical picture of intestinal tuberculosis is of little aid in the diagnosis in the early stages of this disease. On the other hand the roentgen ray may give definite information of colonic ulcerations, though the absence of the

shadows does not exclude this condition absolutely. The roentgen-ray picture presents hypermotility of the bowel, complete evacuation often occurring in from twenty to twenty-four hours, though a small amount of barium may be left in the rectum at the end of this time. In many instances Brown and Sampson found the barium in the sigmoid, the rest of the intestine being empty although a small gastric retention of bismuth was still present. In many cases the cecum and ascending colon manifested the greatest hypermotility. A most important sign is the spastic condition of the bowel involving usually the cecum and cecocolon; the bowel has also an irregular appearance presenting definite filling defects at the seat of the lesions. The presence of this intestinal hypermotility, spasm and filling defects give, according to Brown and Sampson, in a patient with pulmonary tuberculosis almost definite evidence of colonic tuberculosis.

While the above signs are associated with colonic tuberculosis, at the same time a very spastic irritable bowel will frequently be very improperly filled, due to spasm, and give almost an identical picture as that seen in tuberculosis, so that one must be extremely careful not to assume that every case of spasm and improper filling is due to tuberculosis.

6. Ulcerations Due to Carcinoma. In this condition there is a definite filling defect in the cecum, due to the carcinoma. This defect is large, serrated and constant in all the plates. In addition on fluoroscopic examination there is localized tenderness and fixation. Carcinoma of the cecum may exist for a long period of time before obstructive symptoms are noted. It is important in all instances to exercise great care to be positive of the roentgen-ray findings by both fluoroscopic examinations and bismuth enemata.

In a special instance which has come to our attention in which a capable roentgenologist made a diagnosis of carcinoma of the ascending colon, and in which the diagnosis was confirmed by all the methods usually practised by roentgenologists, the filling defect and partial obstruction was found due to the dragging down of the bowel by adhesions connected with an inguinal hernia.

Diagnosis of carcinoma from filling defects should never be made from a single examination. If the bowel is not completely cleared the bismuth may flow around a small mass of fecal material, which will give a filling defect. In such instances it is always well to wait several days and then have the bowels thoroughly cleansed by means of cathartics and enemata and repeat the examination. If the filling defect persists in the same position it is extremely unlikely that this is due to a bit of fecal material, but must be a true filling defect which points probably to malignancy. Small malignant masses, however, can exist in which the growth is so situated that even under the most careful examination no filling defects can be made out by means of the bismuth examination. The bismuth

enema is the method *par excellence* for examination of colonic growths. A large sized growth not producing obstruction may be frequently overlooked by means of the bismuth meal, but will almost invariably be shown by the enema method. This is particularly true when located in the descending colon and sigmoid, which are seldom properly filled when the bismuth is given by mouth.

In conclusion, we hope that we have shown the great aid afforded by the roentgen-ray examination in the diagnosis of lesions in the lower right quadrant. We must bear in mind, however, that this is but one of the many methods by which conclusions may be drawn concerning these intricate disturbances. Like all other methods of diagnosis, at times, by faulty interpretation of shadows, we may be led to a wrong conclusion. As with other lesions the lower right quadrant disturbances should be studied in conjunction with the clinical signs. If the roentgen-ray interpretation is diametrically opposed to all the clinical findings and the two methods cannot be harmonized it is probably wise to adhere to the clinical interpretation. In other words, no one method of diagnosis must be looked upon as absolute.

ERRORS IN THE DIAGNOSIS AND TREATMENT OF DUODENAL ULCER.[1]

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Duodenal ulcer without complications is to be considered in this paper.

The anamnesis will always be considered the most important single factor upon which to predicate a diagnosis of this disease. After describing the typical history, Moynihan says: "It is therefore not necessary to the attaining of a diagnosis that any examination of the patient be made; the anamnesis is everything, the physical examination is relatively nothing."

In a footnote the distinguished author disclaims any desire to eliminate an examination in the diagnostic procedure. The history accepted as typical of duodenal ulcer is well known, but as has frequently been observed, a patient may present the classic history required in Moynihan's postulate without having the disease.

A diagnosis of duodenal ulcer should never be made without a thorough general examination. One requires chemical tests of the chyme, stools, urine, a blood count, a Wassermann test and, most

[1] Read at the annual meeting of the American Gastro-enterological Association, May, 1920.

important of all, fluoroscopy of the chest and abdomen. Lavage eight hours after a Riegel meal is also important, indicating at times a gastric stasis not shown with barium.

No one of the above measures will prove the existence of duodenal ulcer, but all will aid in the differentiation of other diseases with similar histories.

There are no chemical changes in the chyme typical of uncomplicated duodenal ulcer. Neither has the presence of occult blood in the chyme or stool any diagnostic value.

Hemorrhage is a late complication and proves neglect on the part of the clinician.

When we cease to recognize hyperchlorhydria and gastric neurosis as entities, we will overlook fewer early cases of duodenal ulcer.

Fluoroscopy of the chest will frequently disclose an enlarged aorta. This condition, with or without symptoms of an aortitis, is often present and suggests a syphilitic duodenal ulcer or visceral lues. Either of the latter diseases is easily confused with simple chronic duodenal ulcer.

Fluoroscopy of the pylorus and duodenum is an invaluable diagnostic aid when one sees an early hyperperistalsis followed by a later hypoperistalsis and duodenal distortion.

Bourcart[2] has found all patients with round ulcer of duodenum have sagging viscera.

This is quite contrary to twenty years' experience in my own work. Ulcer of the duodenum has rarely been associated in my patients with visceroptosis. In fact the presence of the latter has been considered a diagnostic sign against ulcer.

A roentgen appearance of local constriction in the cap of the duodenum with local tenderness is strong evidence of duodenal ulcer.

Palpation for a tender spot should be made while the patient is in front of the screen. This is the only accurate means to associate the roentgen defect with the pain point. In fact, pressure over the tender area will often cause spasmodic contraction which may be seen in the greater curvature.

Diagnostic acumen will not be improved so long as we are content to say the patient has either duodenal ulcer, appendicitis, cholecystitis or visceral lues. In most instances, painstaking study will enable one to decide upon the correct diagnosis.

Two patients with the so-called pathognomonic history were found to have an uncomplicated cholecystitis without disease in the duodenum. The following case illustrates another error in diagnosis after a rather careful history had been secured.

On January 26, 1914, Mrs. H. L., aged thirty years, was examined. Family history is negative. She had one miscarriage at three months' gestation. Five years ago she was operated upon for ectopic

[2] Rev. méd. de la Suisse romande, May, 1919.

pregnancy. The appendix, one ovary and both tubes were removed. Six months ago she began to have burning, distress and eructations three or four hours after meals. The same symptoms are felt from 1 to 2 A.M. She is relieved by food or soda. The pain is never sufficiently acute to require opiates. There is occasional nausea. The appetite is good and a tendency to constipation exists. Neither vomiting, chills, fever nor jaundice has been experienced. The patient cannot eat acid foods or condiments without later distress.

Examination: Hemoglobin, 80 per cent. Erythrocytes, 4,100,000. Leukocytes, 4500. Blood-pressure: Systolic, 125 mm.; diastolic, 85 mm.

Ewald test-meal: Free hydrochloric acid, 64; total acidity, 92.

Benzidine test for occult blood markedly positive.

The stomach is empty six hours after a Riegal meal.

The stool indicates the presence of occult blood upon repeated examinations following a meat-free diet.

The urine is normal. Percussion, auscultation and fluoroscopy of chest is negative except for a slight enlargement of the aortic arch.

Fluoroscopy of the stomach reveals a persistent, rather extensive filling defect in the antrum pylori. Rectal and sigmoidoscopic examinations are negative. Diagnosis: Duodenal ulcer. An operation revealed a normal gall-bladder, pylorus and duodenum. The liver, so far as it could be observed, was covered with small yellowish-white spots.

The intra-abdominal glands were enlarged. A portion of the liver was excised, sectioned and found to show the histologic character of a gumma.

A few days after the operation a Wassermann test of the blood serum was two-plus positive, Craig system. Mercury and salvarsan effected an apparent cure, which has continued for six years.

Visceral syphilis is frequently accountable for errors in the diagnosis of duodenal ulcer.

The above-cited case in 1914 persuaded me that a routine Wassermann test should be made upon every patient with chronic digestive disturbances. This practice has been followed for the past five years.

It is indeed surprising to note the frequency of lues as the cause of apparent duodenal ulcer.

In a review of my case records numerous instances are observed in which gastro-enterostomy failed to cure duodenal ulcer permanently. An unrecognized lues of the viscera unquestionably accounted for some failures.

Castex and Mathis[3] do not hesitate to affirm, on the basis of their personal observation that before the age of thirty years tardy inherited syphilis is the cause of 90 per cent. of the cases of gastric and duodenal ulcers and 10 per cent. are caused by acquired syphilis.

[3] Abstract, Jour. Am. Med. Assn., 1918, lxxi, 321.

My own observation does not justify this high percentage. However, until the last five years some of my diagnoses have been incorrect.

After every method of examination—laboratory tests of chyme and stool and fluoroscopy of chest and abdomen have been employed—one should make a thorough search for the stigmata of syphilis.

After making a diagnosis of duodenal ulcer, if one finds signs suggestive of syphilis the patient should be given the benefit of antiluetic treatment. This course is indicated even in the absence of a positive Wassermann test.

Internists, as a rule, will agree that the term "cure" following gastro-enterostomy is a misnomer and should be considered "arrested cases."

Late recurrence of duodenal ulcer is more frequently observed by the internist than by the surgeon.

Errors in diet with the use of condiments and acids will often cause a recurrence of the hunger and night pain, months or even years after operation. A patient is with difficulty convinced that life-long attention to proper diet is necessary to prevent a return of ulcer after gastro-enterostomy.

Occasionally operation fails to reveal a duodenal ulcer.

A patient with a typical duodenal history was operated upon and the surgeon failed to demonstrate any evidence of ulcer. A few days later death ensued, following cerebral hemorrhage. At necropsy a linear ulcer in the posterior aspect of the duodenum, with only slight cicatrization, was seen. This patient would probably have been amenable to medical treatment.

Rigid medical treatment in a hospital should be employed before a surgical operation is undertaken. I am firmly convinced that haphazard medical treatment is responsible for many failures.

Absolute gastric rest is impossible during life, but every effort should be directed to approximate that state.

The patient should be given an effective dose of oleum ricini with the beginning of the treatment. He should then be kept in a horizontal position in bed for ten to fourteen days. During this time he must use the bed-pan and not be allowed to raise his head above the pillow. Thirst should be met with clysmata of water (not saline solution). Nutrient enemata may be added.

The duodenal tube is a foreign body near the seat of ulceration and should not be employed. It is, furthermore, usually a source of annoyance to the patient.

Alkaline drugs are well known as stimuli to gastric secretion at an interval after their ingestion, and should be omitted.

Nothing is to be given by the mouth during this ten to fourteen day period. A modified milk and oatmeal diet is then administered at frequent intervals. Quantity and variety of non-irritating foods are then added during the remainder of the four weeks' hospital

residence. At no time during the treatment is more than a three-hour interval allowed to elapse between feedings.

The patient must spend most of the four weeks in bed. Following the hospital treatment, six meals daily must be taken for at least one year. Irritating foods, such as acids, condiments and fried foods, are forbidden.

A regimen such as outlined above will arrest the symptoms and apparently cure an astonishingly large number of patients for long periods.

After the physician has convinced himself by antiluetic treatment or by rest cure in bed, or by both, that the patient is unimproved; then and then only should a surgical operation be undertaken.

CORRECTIONS VERSUS COMPENSATION OF PHYSICAL DEFECTS.

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The inauguration of a program of required physical training for Freshmen in Harvard College necessitated a survey of the general methods already in use. A scrutiny of the multitude of methods employed in many places readily showed there is no generally accepted agreement as to the fundamental principles involved in physical training. There was, of course, a common agreement that physical training is generally beneficial. Most people accept the dictum that the human body is definitely benefited by regular physical exercise. It is also generally agreed that the benefits of physical exercise can be traced to the mind as well as to the body. There is, however, no agreement as to the proper methods to be pursued in attaining this end. As a matter of fact the discussion and also the practice of the procedure to attain the general end of improved bodily condition is very largely concerned with a discussion of methods and fails to take into account the underlying principles. One finds that calisthenics, special gymnasium work, military drill and every form of sport are each heartily recommended as the best method of achieving beneficial physical effects from physical training.

It has seemed to us that methods were entirely secondary to the underlying principles. It has seemed to us that muscular exercise represented by so many foot pounds of work could be performed in a wide variety of ways. It also has seemed to us that the delivery

of muscular exercise was in a sense a prescription which should be based upon an intelligent examination of individuals. In other words, there is probably no blanket prescription, even though one may have to utilize, when dealing with large numbers of individuals, what may be called group prescriptions. The ideal method would be, of course, to base a prescription upon each individual case, and like any medicinal prescription, such prescription takes into account special factors as convenience, palatability, etc. Physicians do not write prescriptions for pills of such a size that they are too large to swallow, nor do they write prescriptions in fluid form for drugs which have a very bad taste which can be concealed under an appropriate coating. A prescription for physical training therefore may justifiably be governed by convenience and palatability as well as by other considerations.

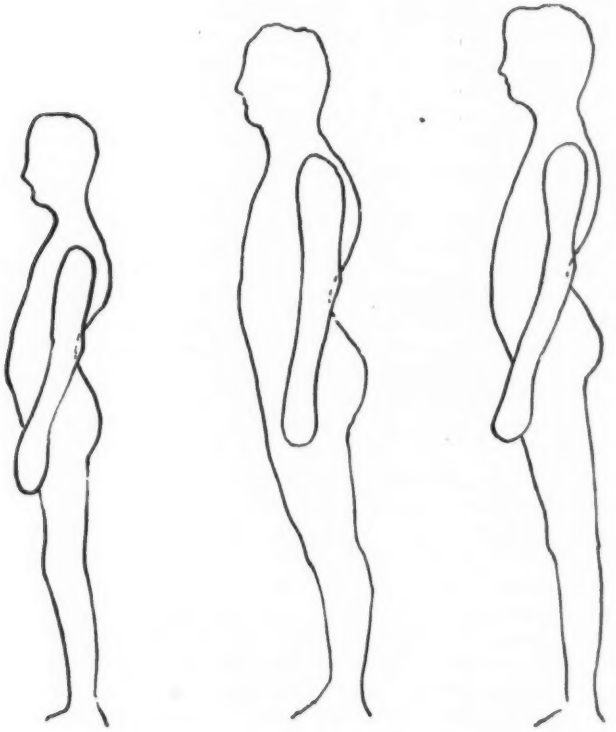
As a preliminary to our prescriptions for physical training we have made a complete medical physical examination. This examination naturally revealed a certain amount of organic defects, some of which were capable of being corrected by standard medical procedures. A certain number of these organic defects, however, might be benefited by physical exercise, even though they were permanent and not capable of correction by ordinary medical therapeutics or by physical training therapeutics. Such defects were at once classified as permanent defects not capable of correction but capable of adequate compensation. In connection with the medical physical examination the individuals were also examined from the point of view of bodily mechanics which took into consideration two factors, namely, the use of the body in the standing position and the use of the feet. The discussion of the classification of bodily mechanics and the general outline of the subsequent procedure has been made in another communication.[1] In summary it was found that 20 per cent. of Harvard Freshmen had satisfactory use of the body, while in 80 per cent. the use of the body was classified as being unsatisfactory. It is evident, therefore, that in the case of 20 per cent. of the individuals the immediate problem was merely that of delivery of physical exercise in order to maintain the satisfactory use of the body. To our minds the method of physical training is of no importance as an immediate problem in those individuals. The method of physical training is of some importance as a life problem looked at from the point of view that it is desirable to encourage individuals to develop satisfactory habits of physical exercise. From that point of view there is a definite choice of methods. It is obviously desirable to encourage some habit of physical exercise which can be maintained at least throughout the early part of adult life. But, as we have said, the immediate

[1] Brown, L. T.: Am. Jour. Orthop. Surgery, 1917, xv, 774. Lee, R. I., Brown, L. T., and Geer, W. H.: In press. American Physical Education Review.

problem in those individuals does not particularly concern methods. In the 80 per cent. of individuals who use their bodies in a more or less unsatisfactory fashion there are definitely two problems, (1) the problem of correction, and (2) the problem of furnishing physical exercise.

It is noteworthy there is no positive relationship between the muscular strength of the individual and the participation in physical exercise on the one hand and good bodily mechanics on the other. In other words, while those who use their bodies properly tended to have participated in some form of physical exercise and to have well-exercised muscles, nevertheless very muscular and very athletic individuals were also found who used their bodies in a very poor fashion. The general, though not the universal, tendency has been to accept powerful musculature and the habit of physical exercise as approximately equivalent to a satisfactory use of the body. Our investigations have failed signally to establish this contention. At the very first we were impressed with the fact that only a small portion of those who use their bodies in an unsatisfactory fashion had symptoms from this unsatisfactory use. At that time the employment of the term "compensated defects" began. It was evident that there was a definite comparison between a heart lesion and a bodily lesion. There are many individuals with heart trouble who are in the stage of a compensated heart defect. Nearly all individuals with heart lesions have an early period of compensation and a goodly proportion continue their compensation throughout life. This compensation may be of a greater or less degree. The comparison holds true of bodily defects. It is possible by good musculature to compensate for bodily defects and to maintain this compensation throughout life. This compensation is likewise of varying degree. A concrete example may be given: C. W. had infantile paralysis in early life, with a resulting marked deformity of his back. He enlisted early in the war, was accepted and served throughout the war without difficulty. He had big muscles and gave the external appearance when dressed of a large, powerful young man. After the war he came to college and took up football, which he had played in preparatory school without difficulty. Hard scrimmaging, however, brought on very definite symptoms in his back. Despite his powerful muscles it soon became apparent that he had adequate compensation for the routine work in life, even for army life, but the compensation of his back defect was not adequate to enable him to play college football. Inasmuch as his defect was structural it was not capable of correction but was merely capable of compensation. It is therefore in this instance necessary to accept compensation as the sole program. The case of F. R. may be utilized as a further illustration. F. R. is a powerful youth with big muscles who has participated in all forms of games and exercise. On examination he is classified as "D," or as having very bad

mechanical use of the body, because he has very unsatisfactory position of his body in standing, and he furthermore uses his feet in an unsatisfactory fashion. The young man has built up an excellent degree of compensation for his functional defects. When he first presented himself he was inclined to be indignant with his classification. It was of course to be expected that he had had no trouble with his back or with his feet. He was put in a group for special



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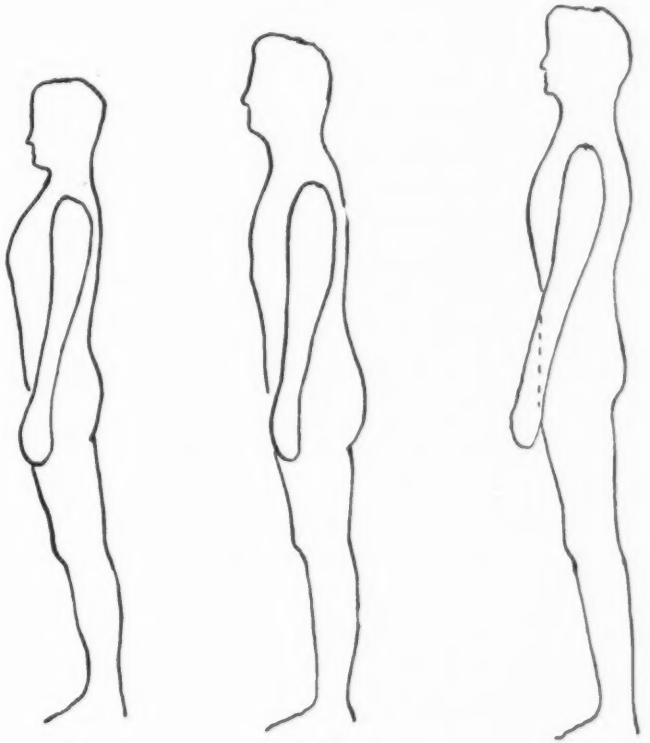
instruction in regard to bodily mechanics. In the meantime he continued his usual vigorous athletic activities. He appeared one day complaining of his feet. To be sure, he had poor boots which in our experience is often the determining factor between compensation and failure of compensation in individuals who use their feet poorly. But the fact remains that despite vigorous athletic exercise and despite his powerful muscles his bodily mechanics failed because he did not use his feet correctly. He has now had his intensive

instruction in bodily mechanics, and it is hoped that he will have his bodily mechanics corrected. Upon the foundation of corrected bodily mechanics he will have physical training which will not compensate for his defects, but will establish more firmly his corrected bodily mechanics.

It has been our experience that back defects are usually fairly well compensated throughout young adult life. We believe this to



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be almost unfortunate because it gives a false feeling of security, and it permits a bad habit to be very firmly fixed. Consequently, when in later life with a diminishing muscular power compensation fails, correction is often difficult and the fixation of the corrected bodily mechanics by habit and by physical exercise may be next to impossible to achieve.

In the case of the bodily mechanics of the feet the question of compensation and correction is somewhat different. It is decidedly

more simple to compensate bad mechanics of the feet by the use of tight shoes or by plates than it is to correct their bad mechanics by sheer muscular power. Consequently when compensation for the mechanical defects of the feet has been lost the individual is often led to try out a large variety of shoes and plates, with the hope of restoring it. Compensation thus restored is always a potential of future trouble unless it is followed by the fixation of correct mechanics by education, habit and physical exercise.

We believe that it is because the results of bad use of the feet are relatively so promptly evident that, on the whole, sounder opinions prevail in regard to correction versus compensation in the feet than in the back; but to our minds the same fundamental principles underlie every form of bodily mechanics. In our program we emphasize correction of all defects when present. Compensation is reserved for irremediable defects such as structural changes of the back. Following correction we insist upon the fixation of correction by physical exercise in the corrected position, and following this stage we encourage general, all-around physical exercise in order to fix more firmly the corrected habit. In other words the stages are, 1, correction; 2, fixation of correction; 3, the habit of exercise in the corrected position; 4, firm fixation of corrected habits. Our experience has confirmed this theoretical consideration because we have not found that faulty habits of bodily mechanics tend to be corrected to any extent by simple exercise. Therefore in the required course of physical training we demonstrate to each individual separately the proper method of standing even if he stands correctly. The class, as a whole, is given lectures demonstrating the principles of bodily mechanics. So far our program for further work has only embraced those who presented very bad bodily mechanics. These individuals are divided into small groups and receive intensive instruction. The result of this instruction has been very satisfactory, as will be seen from the accompanying illustrative charts. Fig. 1*a*, 2*a*, 3*a*, positions assumed by three students at the time of their first examination. Fig. 1*b*, 2*b*, 3*b*, positions assumed by same students after receiving instruction in bodily mechanics when told to stand as well as they could.

These tracings were taken at random from a large series and bring out the fact that although the student started with no knowledge of correct bodily mechanics, at the end of his course of instruction he not only understood the theory of it but could give a practical demonstration.

It is not always possible to achieve satisfactory success with each individual, but it is exceptional that we have not been able to change those classified as "D," or very bad mechanical use of the body into a classification of "B," which means good mechanical use of the body. It will be noted that we have concerned ourselves mainly

with the 25 per cent. who presented the very bad mechanical use of the body. Since the program was tentative and experimental it was decided to await the result of a year's experience in order to see what a single personal demonstration and general lectures would do for the big group of young men classified as "C" who had moderately unsatisfactory mechanical use of the body. While it is true that a considerable number of these were energetic enough to correct themselves, nevertheless the general error of preferring compensation to correction was the more common. We now believe that it is necessary to broaden the intensive instruction so as to include the "C" group as well as the "D" group. This will be put into operation in another year.

We would like to emphasize the importance of a proper nomenclature in any system of physical training. A discussion which involves nomenclature has certain obvious advantages and disadvantages. In general the disadvantages far outweigh the advantages. After all the purpose of nomenclature is to clarify one's conception. Nomenclature *per se* has no particular value. It is only of use when utilized as a means to an end. Too often nomenclature becomes the end and not the means, and a discussion of nomenclature becomes distasteful because it is synonymous with quibbling. Also, it not infrequently suggests that a knowledge of nomenclature is a knowledge of the subject-matter concerned. In the present discussion it is believed that the nomenclature as outlined in the title, corrections or compensation of physical defects, is of some real assistance in the understanding of the subject-matter concerned.

In order to be really successful a physical training program must be based upon careful examination, and this careful examination must be directed toward bodily mechanics with as much care as it is directed toward the heart. Actual structural defects which cannot be corrected and which require compensation are just about as frequent as organic disease of the heart, which likewise cannot be corrected and must be compensated. Judging by our statistics we may assume that the majority of individuals have habits of poor mechanical use of the body, and if left to themselves these individuals may increase compensation but will not correct their defects. It is important that the actual program of physical training be based upon an examination of bodily mechanics. It is possible to give prescriptions for groups of individuals as a result of this examination. All individuals who have poor mechanical use of the body will require as a part of their prescription a preliminary correction. One may expect to see fairly quickly the demonstration of the advantage of correction over compensation in the mechanical use of the feet that is fairly well explained. The same general principle holds true of the mechanical use of the back, but because compensation usually persists for a number of years the untoward effects in the

form of definite symptoms from the bad mechanical use of the back are usually slow in coming. It is possible, however, to correct bad mechanical use of the back, and it is possible to fix rather firmly good habits even in the most unpromising individuals.

We are not prepared at this time to support the theory that many ailments of the nervous system or of the gastro-intestinal system are related to bad mechanical use of the body. We can, however, state that there is a frequent association of such symptoms with the mechanical use of the body. Our investigations have shown that albuminuria of young men which is not a true nephritis is associated almost exclusively with very bad mechanical use of the body. We believe that a sufficient case can be made out for correction as against compensation on the basis of actual ailments of the back and feet, generally conceded to be due to faulty use of the body even without the addition of possible symptoms connected with other organs.

We believe that physical training can only accomplish what it is expected to accomplish when it is based upon satisfactory fundamental principles and when bodily mechanics is regarded in a similar fashion as the disturbances of any other system of the body are regarded.

A CLINICAL STUDY OF WASSERMANN-FAST SYPHILIS, WITH SPECIAL REFERENCE TO PROGNOSIS AND TREATMENT.[1]

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The so-called Wassermann-fast syphilitic infection will probably attract increasing attention as the time during which modern methods of treatment have been employed lengthens and methods of intensifying the sensitiveness of the test demonstrate a smaller and smaller proportion of permanent negatives. A recent survey of the literature following a study of a group of apparently Wassermann-fast cases under treatment in the Section of Dermatology seems to suggest that while Wassermann-fastness is a type of syphilologic tradition, relatively little attention has been paid to critical clinical study of these cases, with a view to ascertaining the types of syphilis that may be expected to give rise to resistant positive reactions in the blood and whether the superficially asymptomatic character of

[1] Presented before the Central Interurban Clinical Club, Rochester, May, 1920.

certain of such cases is borne out by complete investigation. Without any predispositions on the matter we undertook to analyze the clinical picture presented by 101 apparently resistant infections, observed among 458 patients who had received more than twelve intravenous injections of arsphenamin, with appropriate interim mercurialization. While we do not suggest that the amount of treatment these patients received is to be regarded as conclusive evidence that they are Wassermann-fast, our experience has tended to show that patients who do not undergo a reversal of the blood Wassermann with this amount of treatment are likely to present resistant characteristics and will probably not be made negative without the employment of an amount of treatment which raises the question of the possibility of therapeutic injury instead of benefit. Kaplan, particularly, has been outspoken in his injunctions against attempting to reverse Wassermann-fast cases. Craig, on the other hand, has very properly emphasized the searching clinical examination, which must be made before a persistently positive blood Wassermann can be regarded as a solitary and insignificant symptom. It is to be feared that the decline in confidence which seems to have affected the persistent negative Wassermann as evidence of cure may have undesirable by-effects in a tendency to underestimate the persistent positive Wassermann as evidence of the clinical activity of the disease.

The 101 cases employed in this study were obtained from our records without predisposition with regard to the findings and have served as a valuable index of the lacks in completeness in our syphilologic examination. Particularly do we believe that closer attention to the condition of the cardiovascular system in patients with signs of resistant syphilitic infection will show that this group of structures may be the seat of pathologic change when the grosser visible manifestations such as cutaneous, osseous, and neurologic involvements have been brought under therapeutic control.

It is of interest to note that of the 101 cases in which serum Wassermann reactions resisted the amount of treatment described, only four (3.9 per cent.) were florid secondary cases at the time treatment was begun. The remaining 96.1 per cent. included, therefore, Wassermann positive latent cases and various forms of osseous, visceral, cutaneous, and neurologic syphilis and lues hereditaria. Data on the duration of the infection up to the time treatment on this service was begun were obtainable in only 35 per cent. of the cases, the period ranging from two months to twenty-four years, with an average duration of thirteen years. The duration of the presenting symptom averaged two and a half years (in 101 cases). The group, as a whole, therefore, is to be regarded as made up primarily of late syphilis.

Methods of Examination. The methods of examination employed in this group of cases included various combinations of twenty-one

different groups of procedures (Table I). Since the work was undertaken without premeditation very few of the patients had routine or complete examinations as judged from such a schedule. On the other hand the majority of the examinations were more complete than in the average studies of syphilitic infections. The tabulations include the number of cases in which data were available in each type of special examination employed. It should be stated that the Wassermann test employed was performed under the direction of Sanford and consisted of a single Noguchi antigen test, using a rabbit-human hemolytic system with active serum and incubator fixation. Experience has shown this technic to be conservative so that fixed positives obtained with it would, with little doubt, prove persistently positive with any technic employing more highly fortified and multiple antigens or cold fixation.

TABLE I.—THE MULTIPLE PROCEDURE DIAGNOSTIC ATTACK ON SYPHILIS.

1. Intensive study of anamnesis.
2. The social estimation of the case.
3. The study of the family both in history and examination.
4. The serum Wassermann reaction (single antigen).
5. Modifications and intensifications of the serum Wassermann test, such as the provocative, cold fixation, multiple antigens, and Wassermann series.
6. The examination of the cerebrospinal fluid (two Wassermann tests, Nonne, cell count on the fresh fluid, colloidal gold test).
7. The dark-field examination and stains of fresh secretions.
8. The luetin test.
9. The Levaditi and other tissue stains.
10. The neurologic examination.
11. The eye examination.
12. The ear examination.
13. The nose and throat examination.
14. The dermatologic examination of the skin and mucous membranes.
15. Visceropathic studies of the liver and spleen and of the stomach, involving the study of anemias, blood dyscrasias, test-meals, esophagoscopy, roentgen examination, and so forth.
16. The special cardiovascular examination, including the physical findings, blood-pressure, electrocardiographic examination.
17. The roentgenologic examination.
18. Exploratory operative procedures (seldom used until after the therapeutic test).
19. Genito-urinary examination.
20. The therapeutic test.
21. Necropsy.

Table II indicates the number of patients in the Wassermann-fast group who were specially examined for the types of systemic involvement mentioned with the percentage showing syphilitic involvement before treatment was begun.

It will be apparent at once from Table II that cardiovascular syphilis among the patients specially examined for this form of involvement is the principal type of syphilis associated with a resistant positive Wassermann. This finding is in accord with the

observations of Brown on the importance of a search for signs of aortitis in patients who are apparently Wassermann-fast. Of the group of thirty-five patients who had cardiovascular examinations 66 per cent. showed signs of early aortitis and 60 per cent. myocardial changes. There were no patients with hypertension (systolic blood-pressure over 140). It has seemed to us that the more we make systematic cardiovascular examinations of Wassermann-fast patients the more pathology we find. It is, of course, conceivable that a close inquiry into certain symptoms is directing our attention toward this group and allowing to pass unnoticed an equal grade of involvement in some more silent organ, such as the liver or spleen. Syphilis of the central nervous system and syphilis of the osseous system take second place in our experience, in spite of the belief voiced by Kaplan, for example, that a neurologic and cerebrospinal fluid examination in serum Wassermann-fast cases is likely to disclose evidence of general paresis. In 67 of the group of 70 patients who presented evidence of neurosyphilis, examination of both the cerebrospinal fluid and the nervous system was carried out and one or the other examination was done in the remaining 3. Of the twenty-one patients with neurosyphilis underlying their resistance to treatment 40 per cent. have proved to have paresis, 50 per cent. tabes, and 10 per cent. early cerebrospinal syphilis. It is, of course, conceivable that an unascertained proportion of the patients with resistant neurosyphilis of other clinical types than paresis will ultimately develop paresis. Attention will be called to the fact that cardiovascular and neurosyphilis are by no means mutually exclusive, since half the patients with neurosyphilis also had cardiovascular lesions.

TABLE II.—100 WASSERMANN-FAST(?) CASES; TABLE OF STRUCTURES PRESENTING EVIDENCE OF SYPHILITIC INVOLVEMENT BEFORE TREATMENT WAS BEGUN.

System involved.	Number of cases examined.	Percentage showing syphilitic involvement.
Cardiovascular	35[1]	44
Central nervous system	70[2]	30
Osseous	100[3]	30
Visceral (hepatic, splenic and gastric)	100	21
Cutaneous and mucous membrane	100	17
Lues hereditaria	100	10
Lues latens (positive Wassermann only)	100	10

[1] Only the cases receiving special examination by Willius are considered.

[2] Only patients receiving special examination by Sheldon or spinal puncture, or both are considered.

[3] Does not include any routine roentgenologic examination.

The patients presenting osseous involvement failed to show any distinctive type of bone changes standing out preëminent in the

group. Visceral involvement was represented by twenty-one patients, 52 per cent. of whom had gastric syphilis, 47 per cent. hepatic syphilis, and 14 per cent. splenic involvement. The large margin of error introduced into the proportions of hepatic and splenic syphilis by the impossibility of detecting by physical examination lesser degrees of involvement than those necessary to produce palpable tumor or recognizable symptoms must be borne in mind.

Cutaneous symptoms appeared in only 17 per cent. of the cases in our series, and in none of these was the cutaneous condition the sole manifestation of syphilis apart from the positive Wassermann. Nodular and infiltrative lesions served, on several occasions, as valuable clues to the infection, which in the absence of a gross indication for a Wassermann might have passed unrecognized. A particularly large percentage (50) in this group proved, on special cardiovascular examination, to present positive signs, a point which emphasizes the danger of skin-deep interpretation of syphilis and the imperative need to look back of the seemingly easily identified manifestations when a symptom such as Wassermann fastness appears. Only a small proportion (6 per cent.) of the resistant cases with cutaneous involvement presented evidence of neurosyphilis.

Heredosyphilis and syphilis whose existence is evidenced solely by a positive serum Wassermann reaction occupy only a small place among our resistant infections (10 per cent. each).

It is apparent, therefore, that Wassermann-resistant syphilis, far from being trivial or therapeutically minimizable syphilis, is synonymous with grave syphilis, involvement of the cardiovascular system, the nervous and the osseous structures, and the large viscera, constituting 70 per cent. of the total involvement.

Wassermann-resistant late syphilis, in addition to being grave syphilis, is polysymptomatic or exhibits a tendency to multiple structural involvement. This point is best brought out in Table III, in which each type of involvement is cross-indexed, so to speak, to the percentage of other forms of structural involvement associated with the presenting type. For example a patient whose presenting symptom was gummatous osteitis might be found on intensive study to have likewise a neurosyphilis and cardiovascular evidences of his infection. Complications of this sort whose clinical recognition should be the result of multiple diagnostic attack (Table I) have in the past been more conspicuous in the postmortem room than at the bedside, to the discomfiture of the clinician. Failure to recognize such complications during life should become increasingly rare as our clinical diagnostic armamentarium is improved and utilized.

We believe that it is worth while at this point to comment on the gradual approximation of clinical findings to necropsy findings which

can be brought about by the use of group diagnosis in syphilis. To our minds there can be no more convincing evidence that syphilologic diagnosis will never resolve itself into the performance of any single technical test. We believe the logical method for identifying clinical syphilis in obscure cases is identical with that employed in the determination of the types of involvement in our Wassermann-fast cases, and consists essentially of a series of examinations by specialists, each expert in some particular phase of the disease. The results of such composite examination, and particularly the apparent demonstration that Wassermann-fast syphilis is a grave rather than a harmless affair, should compel the greatest conservatism in *ex cathedra* statements regarding the significance of seemingly monosymptomatic positive Wassermanns. Those who are inclined to interpret Wassermann positiveness as a favorable evidence of a high resistance to the infection, and hence of a probable freedom from complications, must, it seems to us, at least subject their material to the most searching and critical examination for every type of involvement before their conclusions can deserve general acceptance. That rash statements with regard to the insignificance of a fixed positive Wassermann may do harm and are to be discouraged until further evidence of its real meaning is available seems to us equally apparent.

TABLE III.—MULTIPLE STRUCTURAL INVOLVEMENT PRESENT IN EACH OF SIX TYPES OF SYPHILIS.

Of 15 patients with cardiovascular syphilis.
- 20 per cent. also had neurosyphilis.
- 20 per cent. also had osseous syphilis.
- 20 per cent. also had cutaneous and mucous membrane syphilis.
- 6 per cent. also had heredosyphilis.
- 6 per cent. also had splenic, hepatic or gastric syphilis.

Of 21 patients with neurosyphilis.
- 50 per cent. also had cardiovascular syphilis (of 6 specially examined).
- 18 per cent. also had osseous syphilis.
- 14 per cent. also had splenic, hepatic or gastric syphilis.
- 4.6 per cent. also had cutaneous syphilis.

Of 30 patients with osseous syphilis.
- 43 per cent. also had cardiovascular syphilis (of 6 specially examined).
- 17 per cent. also had cutaneous syphilis.
- 13 per cent. also had neurosyphilis.
- 10 per cent. also had visceral syphilis.

Of 21 patients with visceral syphilis (splenic, hepatic or gastric).
- 14 per cent. also had cardiovascular syphilis (of 7 specially examined).
- 25 per cent. also had neurosyphilis.
- 14 per cent. also had osseous syphilis.

Of 17 patients with cutaneous and mucous membrane syphilis.
- 50 per cent. also had cardiovascular syphilis (of 6 specially examined).
- 6 per cent. also had neurosyphilis.
- 30 per cent. also had osseous syphilis.

Of 10 patients with heredosyphilis.
- 33 per cent. also had cardiovascular syphilis (only 3 specially examined).
- 20 per cent. also had neurosyphilis.
- 20 per cent. also had osseous syphilis.
- 40 per cent. also had interstitial keratitis.
- 30 per cent. also had eighth nerve deafness.

Three points stand out conspicuously from the foregoing study: (1) The more carefully the search for cardiovascular syphilis is carried out in Wassermann-fast cases which exhibit other signs of active disease on first examination the more often cardiovascular syphilis is recognized. This finding is in accord with necropsy experience with syphilis in general, as presented by Warthin, Symmers and others. The former in particular found the heart and aorta involved to some degree in every case and rates myocarditis as the most common cause of death from syphilis. (2) Wassermann-resistant patients who have some definite clinical manifestation of syphilis as a presenting symptom on superficial examination are likely to exhibit multiple types of involvement on complete examination. The type of infection presenting a resistant positive Wassermann is therefore probably not produced by a special strain of organism, and Wassermann fastness should therefore probably be interpreted less as a single symptom than as a guide to an underlying multiplicity of symptoms. The conspicuous exception is the long-recognized inverse relationship between cutaneous and neurosyphilis which seems to be the only example of a mutually exclusive combination in the series. (3) The last point suggested by this study is that there is a curious, almost paradoxical contrast between syphilis whose only symptom after careful examination is a positive Wassermann and syphilis with both active lesions and a positive Wassermann whose resistant character becomes apparent only after treatment. Our group of such pure latent cases is too small and our period of observation too short to justify a prediction as to whether these patients will ever develop active manifestations. We do not therefore offer here any generalizations on the possible protective significance of the monosymptomatic serum Wassermann. That only 10 per cent. of such monosymptomatic Wassermanns appeared in our series suggests at least that the group in which Wassermann-fastness can be dismissed as meaningless is very small.

Certain incidental observations from our series are based on groups of cases too small as yet to deserve detailed analysis. One such interesting incidental finding was the presence of septic foci in teeth, tonsils, and elsewhere in 74 per cent. of the cases. We are not prepared to suggest the relation of this detail to the resistant Wassermann or to the polysymptomatic character of the infections in this group. In 29 per cent. of the cases the foci were removed without effect on the Wassermann. Only 12 per cent. of the patients were users of alcohol. In view of the well-known inhibitory effect of acute alcoholism on the positive serum-Wassermann reaction such a finding may ultimately prove of interest. There was no evidence that pregnancy and childbearing had any relation to the resistant Wassermann reaction.

Treatment of the Resistant Wassermann Patients. It will be recalled that for the purposes of this paper we defined our Wassermann resistant group as consisting of those cases which were not permanently reversed to negative in the blood by a minimum of twelve injections of arsphenamin and interim mercurialization by inunction. This amount of treatment left Wassermann positive only four of the early cases seen on the service. It appears, therefore, that the resistant Wassermann in our experience is a manifestation of late syphilis (average duration of disease thirteen years in 35 cases and of symptoms two and a half years in 90 cases). An analytical *resume* of our treatment technic in these cases is as follows:

Minimum number of arsphenamin injections	12
Maximum number of arsphenamin injections	29
Average number of injections for each patient	14
Average number of injections for each course	6
Average number of courses for each patient	2½
Average period over which the above treatment was given	11 months
Average interval between injections	1 week
Average total duration of arsphenamin treatment	2½ months
Average number of inunctions given (90 patients)	90, 4 gm. 33 per cent.
Average number of inunctions given for each course	40
Average number of succinimid injections given (21 patients)	21, ⅛ gr. daily
Average total duration of inunction treatment	4¼ months

Summarizing, it appears that the average Wassermann resistant patient in our series remained Wassermann positive after fourteen arsphenamin injections and ninety 4 gm. 33 per cent. inunctions administered intermittently in eleven months and equivalent to about six months' continuous treatment. It should be mentioned that we often employ arsphenamin and mercury simultaneously, thus shortening the continuous period as compared with the intermittent period.

This amount of treatment, then, has secured the reversal of about 96 per cent. of our early cases and 78 per cent. of our late cases. It is interesting, for example, that Detweiler reports 57 per cent. of a large series reversed by eight injections of diarsenol. The fallacy of comparisons between such series is easily appreciated by recalling that the serum-Wassermann reaction has no standard meaning for all observers. An insensitive test which is a valuable guide to Wassermann fastness is a poor guide to therapeutic effect, since in the former it picks out as fixed positives cases whose Wassermann reactions would certainly be positive with hypersensitive antigens or cold fixation, while in the latter it results in premature negatives which a sensitive technic would still recognize as positives. An observer using a hypersensitive Wassermann therefore secures fewer reversals than one using a conservative technic. We find ourselves in full accord with Wile and Hasley in refusing to accept

even a persistent negative Wassermann reaction as evidence of cure, since its meaning is largely a matter of technic. The present study, however, compels us to reserve our opinion on their espousal of the obverse view that "in the presence of an intensive therapy a positive test does not mean living spirochetes and a potential syphilis."

So far as symptomatic therapeutic effects are concerned the clinical results in our series of 101 Wassermann-resistant cases were much more satisfactory than the serologic. In 84 per cent., in spite of the persistent positive Wassermann, the infection was symptomatically arrested *pro tempore* and the visible lesions disappeared. In 16 per cent. the disease continued to progress or clinical evidence of active syphilis persisted. Of the 16 patients not responding to the above therapy, 6 had paresis, 3 had gastric crises in tabes dorsalis, 2 had cerebrospinal syphilis, 2 had interstitial hepatitis, 1 cyclic vomiting, 1 myocardial degeneration, and 1 a persistent anemia. We wish to enjoin conservatism in the attempt to make ultimate interpretations of the above results. Regardless of the degree of symptomatic improvement achieved no one of our series of patients will be voluntarily dismissed by us from observation throughout life.

The question of the amount of treatment which it is proper to administer to a Wassermann-resistant patient is no more susceptible of exact definition and reply than are the many other questions centering around the problem of standard procedures in syphilotherapy. With the immunologic meaning of the complement-deviation test still obscure, the first essential to a decision is lacking. The second essential, too generally overlooked, is almost as far from adequate understanding. Until we have a more exact comprehension of the harm which excessive treatment may inflict on the body, and notably on the excretory mechanism and on tissues on which the treatment employed has a selective toxic effect, we cannot, at least in late and Wassermann-fast cases, make that exact estimation of balance between the potential evils of the disease and the evils of therapy which the occasion demands. We have therefore adopted as guides to treatment tentative principles as follows:

1. Search every accessible organ and tissue in the Wassermann-fast case by every clinically available method for evidence of syphilitic changes.

2. Weigh the degree of activity of the process and the extent of damage and probable recuperative power of the most vital structure involved by the infection.

3. Identify the weakest element in the patient's make up and estimate the tolerance for arsenic and mercury of the structures which must bear the brunt of treatment by-effects, such as the liver, kidney, and skin.

4. Do all that can be done to increase tolerance of treatment by protective measures, by extirpation of focal infection and by selection of the therapeutic agents.

5. Direct the treatment of Wassermann-resistant patients less toward overcoming the resistance offered by the Wassermann reaction and more toward a satisfactory symptomatic response of the vital structures involved by the disease within the limitations imposed by the weakest element in the tolerance. Get all the symptomatic effect possible short of recognizable damage. If tolerance permits give at least as much treatment as to a fully developed secondary case.

6. Recall the fallibility of human judgment, which in syphilotherapy at least has had neither the time nor the means to achieve conclusive results, and always regard the Wassermann-fast patient as potentially syphilitic, and for that reason not to be dismissed from careful search for evidence of activity at intervals throughout life.

Summary. 1. Of 458 syphilitic patients who had received from twelve to twenty-nine arsphenamin injections combined with mercurial inunctions, the average being fourteen injections and ninety inunctions in eleven months, 6.6 per cent. of primary and secondary cases and 101, 22 per cent., of latent, late and hereditary cases (average duration thirteen years) remained persistently Wassermann positive.

2. Cardiovascular changes are apparently those most likely to underlie a resistant positive Wassermann test in late syphilis (44 per cent.), with neurosyphilis 30 per cent., osseous lesions 30 per cent., hepatic, splenic, and gastric syphilis 21 per cent., and other types from 10 to 17 per cent.

3. More than one type of involvement was the rule in the individual cases of this group. There were only 10 patients presenting no other evidence of syphilis than their positive Wassermanns.

4. Patients with syphilis should therefore be studied from other angles than that of the presenting type of involvement, in the effort properly to appraise their condition and susceptibility to treatment.

5. Sixty-five per cent. of the patients with cardiovascular syphilis had aortitis and 60 per cent. myocardial changes.

6. Of the neurosyphilitics, 40 per cent. had paresis and 50 per cent. clinical tabes dorsalis.

7. Fifty per cent. of patients with neurosyphilis had cardiovascular syphilis also.

8. Gastric and hepatic syphilis were recognized in 52 and 47 per cent. of the visceral cases as against only 14 per cent. presenting recognizable splenic involvement. Patients with cutaneous syphilis showed the familiar immunity from neurosyphilis and the reverse.

9. While pyogenic foci were present in 74 per cent. of the patients with resistant-Wassermann reactions no frank etiologic connection

was apparent. The same was true of alcohol, which was used by only 12 per cent. of these patients.

10. There was no evidence that Wassermann-fastness is the result of infection with any special strain of organism. In fact, the "polystructural" involvement in such cases suggests the contrary.

11. Eighty-four per cent. of the patients in our Wassermann-resistant group have undergone symptomatic arrest today under the treatment received. Paresis and tabes dorsalis with gastric crises formed more than half the failures.

12. The amount of treatment to which a Wassermann-resistant patient should be subjected cannot be exactly defined. The principles employed in making a decision, which are in effect the principles underlying the therapy of all late syphilis, are outlined on page 666. In particular, reversal of the Wassermann, while desirable, should not be the primary aim of the therapy. Symptomatic response, with arrest of the process, and the giving of as much treatment as to an early case, provided tolerance permits, are the important considerations.

13. A persistently positive serum Wassermann reaction seems to be an accompaniment of grave rather than of trivial syphilis. At least such is the case in enough instances to suggest the need for the most painstaking and repeated investigation of the clinical aspects of the Wassermann-fast case. Premature statements based on insufficient evidence as to the insignificance of a fixed positive Wassermann reaction are, we believe, to be deprecated.

14. Wassermann-fast patients should not, in our opinion, be discharged from periodic careful reëxamination, with special reference to the cardiovascular and nervous systems throughout life. The frequency of such examinations should be dictated by the gravity and extent of the original process and the degree of apparent resistance to treatment.

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INFLUENZA PNEUMONIA: CERTAIN RADIOLOGICAL FEATURES OF THE DISEASE IN THE EPIDEMIC OF 1920.

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and
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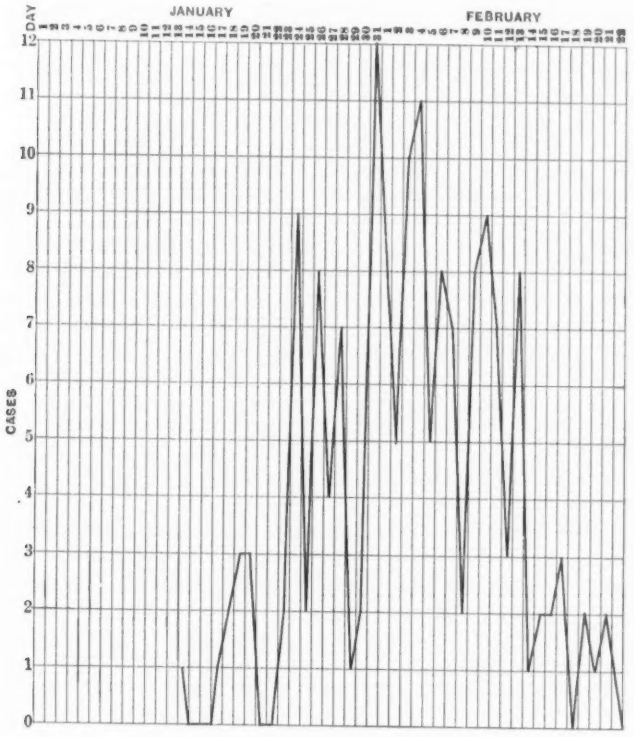
In the epidemic of 1918 a very unusual opportunity was given to study the pulmonary changes from the earliest moment of onset to final changes that resulted in the death of the patient. The result of that work was published in 1919.[1] The main features were briefly an early general pulmonary congestion; a rapid development, the climax often being reached in four days; pneumonia developing frequently twenty-four hours after influenza onset. The pneumonias progressed from the hilus, in almost 50 per cent. of the cases, and in 33 per cent. they progressed from the right base. In the true influenza cases which did not develop into pneumonias the greatest congestion was of the hilus and the mediastinum, with peribronchial thickening. The cases developing into bronchopneumonias and bronchial congestion were very noticeable, rapidly developing into small localized areas of congestion, with true confluent parenchyma congestion following immediately. In some cases there was difficulty in differentiating bronchopneumonias from lobar pneumonias. In the majority of cases the early dilatation of the heart and the high position and increased dome shape of the diaphragm were marked features. In the series of 91 cases studied 52 were cases of bronchopneumonia and only 4 of lobar pneumonia. The radiographic appearances were consistent and typical.

In view of the fact that a study had been made in 1918 it was thought of sufficient interest and importance to attempt a study of the present epidemic. No true comparison, of course, can be made. The conditions under which this study was carried out were far from ideal, the class of patients entirely different, control and coöperation lacking, clinical data insufficient, autopsy corroboration unobtainable, so that in many ways the present study should in no way compare with the results obtained in 1918. There are, however, certain very definite changes observed and results obtained which are significant, and to a certain extent they compare with the general mild clinical and epidemiological features observed in the present epidemic. Moreover the radiographic findings are comparable and for the sake of simplicity the cases studied have been put into purely arbitrary groups, based solely on the changes observed in the radio-

[1] Honeij, James A.: Influenza and Bronchopneumonia: A Study of the Epidemic from a Roentgenological Point of View.

grams. The following general information is given regarding the number, source and type of cases from which our series were obtained:



GROUP I. *Lobar Pneumonia.* This group consists of 6 cases of definite lobar pneumonia. There is some congestion throughout both lungs. The only significant feature is the typical localized area of density. The base of the process is at the periphery and its apex at the hilus. In no case does the process occupy more than one lobe. In all 6 cases the diaphragm is high and the right auricle of the heart is dilated. In 2 cases there is a question of pulmonary tuberculosis—in all a definite history of influenza. Of these 6 cases 2 died and 4 recovered.

GROUP II. *Diffuse Light Probable Bronchopneumonias.* This group consists of 14 cases. The radiographic examination shows, without exception, a unilateral pulmonary process. In a few cases it was accompanied with congestion on the other side. In the majority of cases the density seemed greatest around the hilus and

bases. Although the lungs were increased in density there were areas in which the density is more or less localized, but of a light, diffuse nature, and in most cases quite extensive. Although these cases were chosen from the daily clinic, with no intention of selection they presented the same features above described. It was impossible to definitely state whether they were lobular or lobar pneumonias. In the more extensive processes, with one exception, the heart and diaphragm and other detailed pulmonary structures could be seen through the density. In the majority, bronchial markings were increased. There was no consistent change in either mediastinum, diaphragm or heart, although in the majority of cases there was some dilatation of the right auricle and pulmonic area of the heart. The diaphragm in a few cases was rather high in position. In a few cases emphysema was present. Of this group 4 died and 8 recovered.

GROUP III. *Diffuse Light Pneumonias.* This group consists of 12 cases. It is comparable to Group II as far as the general light diffuse density is concerned. All the cases presented a unilateral process at the base with one exception, which was bilateral; 5 occurred at the left base and 7 at the right base. There is no evidence that these are bronchopneumonias. The density is sufficient to slightly obscure the outline of heart and diaphragm, but definite pulmonary markings are discernible through the density. This density was not demarcated and gradually faded out. There were no striking associated features in either mediastinum, heart or diaphragm. In some of the cases the mediastinum is slightly increased in width and in only 2 cases are the borders slightly obscured by the mediastinal density. In 3 cases the diaphragm is somewhat high but not exceptionally so if compared with the size of the thorax. Two of these cases died and 9 recovered.

GROUP IV. *Diffuse Congestion.* This group consists of 5 cases. It is a group that was originally described as diffuse congestion. The only feature of significance was an increase in the width of the mediastinum and considerable increase in density along the peripheral borders of the lungs in 3 out of 5 cases. All 5 cases recovered.

GROUP V. *Typical Bronchopneumonias.* This group consists of 6 cases. The outstanding feature is the irregular, patchy density, peribronchial in type, extending from the hilus outward in all directions. In general there is very little pulmonary congestion outside of the areas described—largely unilateral in type. The associated changes are quite marked. The diaphragm is high; the mediastinum is obscured and increased in width, with the exception of 1 case. There is some dilatation of the auricle and pulmonic area of the heart. In 1 case this is slight.

This group was taken as a contrast to Group I and Group III, which are the two important groups. Two of this group died and four recovered.

Of the 43 cases in the five groups, 40 were charted and an attempt made to compare the clinical with the radiographic information. The following information was sought: The age, sex, previous respiratory diseases, duration of illness before radiographic examination, clinical symptoms, pulse, temperature, physical signs, both front and back, clinical diagnosis, blood examination, pneumococci type determination and end-results. These results were not compared until the cases had been grouped radiographically, studied and recorded. The result of the charted cases is as follows: The ages of the patients were between nineteen and sixty years, the greatest number, more than one-half, were between twenty-five and thirty-five years of age. There were twenty-five male and fifteen female patients. Except for 3 cases, none of the patients gave a history of having had influenza previously. The duration of the disease previous to radiographic examination was from one to twenty-three days. The typical clinical symptoms of chills, fever, headaches and "pains all over" prevailed in practically all cases. The highest temperatures occurred in Groups I and II. In Group III no temperature exceeded 103°. The pulse was over 100 in all but 4 cases. The physical examination was of interest, as in 9 cases only were pulmonary changes recorded in front of the chest, while in the majority the physical signs were at the back and bases. There was no predominating physical sign nor did the physical findings in type differ from the previous epidemic. The clinical diagnosis was recorded in most cases after radiographic examination, so that no comparison can be made. The blood examination gave no information of value so far as the grouping of our cases is concerned. It depends on too many diverse factors to draw any group comparison. The white blood cells varied in number from 5 to 30,000. The pneumococci type determination bears no relation apparently to the type, degree or extent of radiographic changes so far as the groups are concerned. In Type IV, however, 9 cases recovered and 6 died, this being the greatest number.

The end-results in this group of 40 cases showed that 12 cases died, 27 recovered and 1 was not recorded. In Group I, 2 died and 4 recovered. In Group II, 4 died and 8 recovered. In Group III, 2 died and 9 recovered. In Group IV, all recovered, and in Group V, 2 died and 4 recovered. Three cases were complicated, of which 2 died.

Although no definite conclusions are obtained from this analysis there are several interesting points to be noted if compared with the radiographic findings. In Groups III and IV, which are the groups that radiographically are less serious than the other groups, the temperatures were lower and end-results better, with fewer fatal cases, than in any of the other groups. In the majority of cases the physical findings at the back and bases gave no indication of the type or position of the pulmonary density seen on the radio-

grams. These physical signs, however, simply indicated the general congestion, which was most notable at the bases and seen radiographically in all cases. It is interesting to note that only three of the cases gave a previous history of having had influenza.

From a radiographic point of view the significant features of the findings in this epidemic as compared with the findings in the previous epidemic can be stated briefly as follows: In Groups II, III and IV the pulmonary congestion was lighter and more diffuse; although more or less localized, it occupied a large lung area, with less associated cardiac and diaphragm reaction than in the cases in 1918. There was less congestion of the hilus, peribronchial, mediastinal tissues and tracheobronchial glands. This diffuse, light pulmonary congestion bore no relation to the duration of the disease in that our cases were radiographed anywhere from one to twenty-three days after admittance.

There is here no evidence that our cases were typically bronchial or lobar in character which was such a specialized feature in 1918. The process developed slower and in no such well-defined manner, as in the cases of the previous epidemic. The general pulmonary congestion in all 52 cases was no different from that previously seen. These facts suggest, therefore, that in the majority of cases we were dealing with a pulmonary infection that was less severe than the infection of 1918.

Total cases 138—of 124 cases age incidence as follows:

— 20	20–25	25–30	30–40	40–50	Over 50
10	28	31	30	15	10

Duration of disease at entrance:

Days	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	20	21
Cases	9	37	17	22	14	16	15	6	5	5	1	2	..	4	..	..	1	1

History of previous influenza:

Total cases 138—12 cases or 8.7 per cent.:

Clinical Diagnosis:

Bronchitis or influenza.	Bronchopneumonia.	Lobar pneumonia.	Empyema.
68	79	11	3

Type determination—58 cases:

Type I	II	III	IV	Strep. viridans	Strep. hemolyticus	Strep. mucosus
4	..	9	31	3	8	3

Mortality—161 cases: 46 died, or 28.57 per cent., or 285 per thousand.

From these 138 cases 52 had radiograms made and studied. These cases were divided into five groups according to the changes

observed radiographically. They were compared with a group of 9 cases of influenza so that in all cases there would be a so-called standard for comparison. The description of this group is as follows:

Influenza Group Used as a Control in Studying a Group of Pulmonary Congestion Cases and Changes Consistent with Early Bronchopneumonia or Diffuse Pneumonia. Examination of the radiograms of 9 cases shows more or less the same changes. The lungs throughout are slightly increased in density. In the majority of cases there is a slight increase in the width of the mediastinum. The hilus is rather large, increased in density and of very irregular outline. Radiating from the hilus the peribronchial thickening is quite marked. There are no marked diaphragmatic or cardiac reactions. In all the cases the pulmonic area of the heart is dilated but consistent with the degree of pulmonary congestion. There is no marked elevation of the ribs. In a few cases there is some emphysema at the bases and in others an emphysema which might be called compensatory in type.

Of this group three are males and six females. All recovered.

OBSERVATIONS ON THE LATEST (1920) RECRUDESCENCE OF INFLUENZA: A DETAILED CLINICAL STUDY OF 100 CONSECUTIVE CASES.

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During the first two weeks of January of this year (1920) cases of respiratory infections resembling clinically the ailment known as influenza or la grippe became prevalent in this city. During the third week of the month the cases became more numerous. Instances of several individuals in the same household being affected were quite common and severe infections resembling the fatal cases of the last epidemic made their appearance. Special wards for influenza patients were opened in the Waterbury Hospital and the following observations are the results of the laboratory and clinical studies of 100 consecutive cases treated. On the whole, these cases represent the majority of the worst patients during the epidemic, although a few of our cases were comparatively mild.

The object of this paper is to record the clinical features of the epidemic, also the bacteriologic findings, and to present the logical deductions that one may draw from them.

Analysis of the Cases. Of the 100 patients treated, 49 were males and 51 were females. The age incidence was as follows:

Below 5 years	4
Between 5 and 10 years	2
" 10 and 20 "	6
" 20 and 30 "	35
" 30 and 40 "	37
" 40 and 50 "	8
" 50 and 60 "	4
Above 60 years	4
	100

Date of onset: The onset arranged by weeks was as follows:

January 4 to 10	6
11 to 17	15
18 to 24	34
25 to 31	24
February 1 to 7	13
8 to 14	6
15 to 21	2
	100

The rapid rise in the number of cases and also the abrupt subsidence of the epidemic is shown in the accompanying chart (Fig. 1).

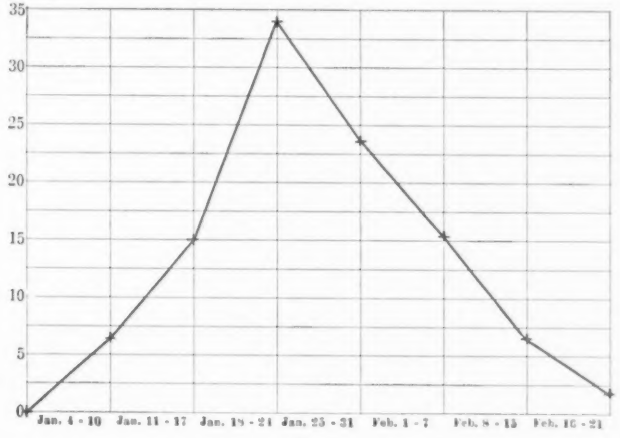

FIG. 1

Influenza during the Last Epidemic. In only 2 of the cases (both of which recovered) were we able to elicit a history of having had the influenza during the epidemic of last year. In 1 case the infection was mild, keeping the patient in bed but one day. In the other there was a history of bronchopneumonia of six weeks'

duration. A history of previous attacks of pneumonia was obtained in 4 cases: 1 ten years ago; 2 six years; and 1 three years prior to present admission. In the rest of the patients there was no history of any respiratory affection sufficient to confine them to bed. A history of frequent attacks of rhinitis and "colds" was obtained from a number of the patients, but its frequency was no higher than in 100 other patients similarly questioned.

Mode of Onset. Before the patients were confined to bed there was generally some malaise and headache of about twelve to twenty-four hours' duration. Chilliness was present in 95 per cent. of cases. In 12 per cent. of the cases it was very marked—an actual chill—from the very beginning. In 76 per cent. of the cases that subsequently developed pneumonia a renewed chill of marked severity ushered in the beginning of consolidation. Sneezing was not conspicuous during the epidemic (3 per cent.), while rhinitis and "a cold in the head" were present in 14 per cent. of cases. In the majority of instances the illness commenced with general malaise, headache, chilliness, pain in the back and prostration. Cough was an early and distressing symptom in 74 per cent. of cases.

Clinical Course and Physical Signs. Of the 100 cases investigated, 48 had marked pneumonic involvement, 18 cases had severe bronchitis, with several small areas of bronchopneumonia; 28 patients had a bronchitis of moderate severity, while 6 other patients had merely a pharyngitis with slight tracheitis.

In 16 cases under our observation we had the opportunity to note the development of pneumonia from its very onset. None of these cases had the abrupt onset that goes with lobar pneumonia. They did not have the severe chill, the sudden rise of temperature and the rapid development of the disease as commonly seen in cases of lobar pneumonia. On the other hand, almost invariably the history obtained from the patient was that of an ordinary cold, with a slight bronchitis. He presented the symptoms of a slight infection. He generally had a dry, hacking, non-productive cough, with some presternal pain. The temperature was usually about 102° F. on the first day and about 102° to 103° F. on the second day. A diurnal variation of temperature was quite marked. If no complications developed the temperature usually came down by lysis and remained normal after four or five days of irregular pyrexia. In the cases complicated by pneumonia the diurnal variation of temperature became less marked, and usually on the fourth to the sixth day of illness the temperature would suddenly rise 2° or 3°, generally preceded or accompanied by a marked chill. At this time the physical examination of the chest would reveal a small localized area where the rales were finer than elsewhere. Percussion was generally negative at this stage; the breath sounds were very little altered but spoken, and particularly whispered voice was frequently increased over the involved area. The area of involvement when

first observed in these cases was usually small (about the size of a half-dollar) and circumscribed. The most frequent location of the early signs of consolidation was in the upper part of the lower lobes posteriorly (Fig. 2). Gradually the involvement extended, and in the course of two or three days a large part or perhaps an entire lobe of a lung was involved. Involvement of contiguous parts of the lung was gradual. Neighboring lobes were frequently involved four to six days after the first evidence of consolidation. Similarly, areas of bronchopneumonia or evidences of lobar pneumonia would appear on the opposite side of the chest many days after the appearance of the primary signs.

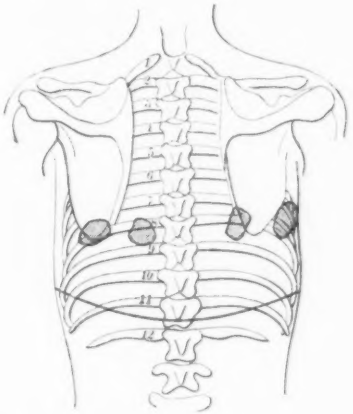

FIG. 2.—Areas where the earliest signs of consolidation were most frequently observed.

Five fatal cases of pneumonia were seen during the epidemic, which simulated very closely the fulminating influenza pneumonia cases seen last year. They had the mottled cyanosis when first seen. Epistaxis was profuse and prostration marked. The pulse was comparatively slow and the leukocytosis was either normal or else a leukopenia was present. The postmortem findings were those of large areas of bronchopneumonia in both lungs, with generally a lobar involvement of one or more lobes. Bacteriologically these cases were mixed infections. The influenza bacillus was found in two such cases, one in combination with the pneumococcus and the other with the streptococcus. In the rest of the cases the pneumococcus and streptococcus were isolated.

Considering the symptoms of the other cases we found several features predominating, which accentuated certain differences from a similar series of pneumococcus pneumonias.

TABLE I.—TABULATION OF THE BLOOD AND BACTERIOLOGIC FINDINGS IN FORTY-EIGHT CASES OF PNEUMONIA.

No.	Name.	Age.	Sex.	Diagnosis.	Blood.		Throat.		Sputum.		Blood culture.	Group.	Termination.
					White blood cells.	Polynuclears.	Pfeiffer.	Other organisms.	Pfeiffer.	Other organisms.			
1	Mrs. D.	24	F.	Lobar pneumonia, right base	24,000	74	0	Streptococcus; pneumococcus	0	Pneumococcus; streptococcus; M. catarrhalis	Negative	II	Recovered.
2	A. E.	31	F.	Lobar pneumonia, double	24,200	78	+	Pneumococcus	+	Pneumococcus	Pneumococcus	IIa	Recovered.
3	Ford	84	M.	Bronchopneumonia, diffuse	16,400	83	+	Pneumococcus; streptococcus	+	Pneumococcus; streptococcus	.....	II	Recovered.
4	D. McD.	26	M.	Lobar pneumonia, 3 lobes	18,200	94	+	Pneumococcus; streptococcus	+	Pneumococcus; streptococcus; M. catarrhalis	Streptococcus (mucosus)	III	Died.
5	B. B.	30	M.	Lobar pneumonia, 2 lobes, right	33,000	86	0	Pneumococcus; streptococcus	0	Pneumococcus; Friedländer's; streptococcus	Negative	II	Recovered.
6	H. W.	42	M.	Lobar pneumonia, right middle	34,600	82	0	M. catarrhalis; streptococcus	0	Pneumococcus; streptococcus	Negative	II	Recovered.
7	R. P.	23	M.	Lobar pneumonia, right base	29,000	89	+	Streptococcus; staphylococcus	+	Pneumococcus; M. catarrhalis	Negative	II	Recovered.
8	J. R.	41	M.	Lobar pneumonia, double	31,200	86	+	Streptococcus	+	Pneumococcus; M. catarrhalis	Negative	III	Recovered.
9	LaR.	26	F.	Bronchopneumonia, diffuse	12,400	71	..	.....	+	Pneumococcus	Pneumococcus	IV	Died.
10	J. B.	36	M.	Lobar pneumonia, right base	20,600	90	0	Pneumococcus; streptococcus	0	Pneumococcus streptococcus	Pneumococcus	I	Recovered.
11	Mrs. Day	34	F.	Lobar pneumonia, 3 lobes	...	...	...	.....	0	Pneumococcus streptococcus	.....	II	Recovered.
12	C. W.	14	F.	Lobar pneumonia, right base	7,800	79	0	0	+	Pneumococcus	.....	IV	Recovered.
13	F. B.	24	M.	Bronchopneumonia, diffuse	21,200	87	0	Streptococcus; staphylococcus	+	Pneumococcus; M. catarrhalis	Negative	II	Recovered.
14	J. Biero	36	M.	Double pneumonia	20,600	90	0	Pneumococcus; streptococcus	0	Pneumococcus; streptococcus	Pneumococcus	I	Recovered.
15	E. G.	29	M.	Lobar pneumonia, left lung	13,200	77	..	.....	+	.....	Pfeiffer	...	Died.
16	Mrs. B.	56	F.	Bronchopneumonia, diffuse	22,000	87	+	Streptococcus	+	Streptococcus; pneumococcus	.....	...	Recovered.
17	Waz.	36	M.	Lobar pneumonia, left base	15,000	81	0	Pneumococcus; streptococcus	+	Pneumococcus	Negative	IIa	Recovered.
18	De F.	..	F.	Lobar pneumonia, right middle	24,200	87	0	Staphylococcus; streptococcus	0	Streptococcus; pneumococcus	.....	IV	Recovered.
19	H. S.	3	F.	Lobar pneumonia, left lung	18,200	74	..	.....	..	Pneumococcus	Negative	III	Died.
20	M. G.	24	M.	Lobar pneumonia, left base	16,600	72	..	.....	+	Pneumococcus	.....	III	Recovered.
21	Mrs. R.	..	F.	Lobar pneumonia, left base	18,200	86	..	.....	0	Pneumococcus; streptococcus	.....	III	Recovered.

22	Mrs. W.	32	M.	Bronchopneumonia, diffuse	14,000	87	0	Pneumococcus; streptococcus	+	Pneumococcus	.....	IV	Recovered.
23	D. M.	16	M.	Lobar pneumonia, right upper	8,500	74	+	Staphylococcus; pneumococcus	+	Pneumococcus	.....	IV	Recovered.
24	Mrs. E.	35	F.	Lobar pneumonia, left base	9,200	88	+	Pneumococcus; streptococcus	+	Pneumococcus	Pneumococcus	II	Died.
25	E. P.	..	M.	Lobar pneumonia, left base	4,300	73	+	Streptococcus	0	Staphylococcus; streptococcus	.....		Recovered.
26	Mr. H.	32	M.	Lobar pneumonia, right upper	8,100	50	..	.....	+	Pneumococcus	.....	..	Recovered.
27	Mrs. A.	29	F.	Lobar pneumonia, right lower; middle	9,200	74	..	.....	..	.....	.....	..	Died.
28	Miss W.	23	F.	Lobar pneumonia, left base	9,200	72	+	Pneumococcus; streptococcus	+	Pneumococcus; B. fusiformis; M. catarrhalis	.....	I	Recovered.
29	J. K.	..	M.	Double pneumonia	5,000	50	..	.....	0	Streptococcus; M. catarrhalis	.....	..	Died.
30	A. M.	..	M.	Double pneumonia	9,600	86	+	Pneumococcus; streptococcus	+	Pneumococcus; streptococcus	.....	Neg.	Recovered.
31	Mcl.	..	M.	Double pneumonia	5,600	77	0	Pneumococcus; streptococcus	+	Pneumococcus	.....	IV	Recovered.
32	F. Z.	..	M.	Lobar pneumonia, right base	6,200	78	..	.....	..	.....	.....	..	Died.
33	Mrs. Du.	..	F.	Lobar pneumonia, left base	14,600	83	..	.....	0	Pneumococcus; streptococcus	.....	..	Recovered.
34	H. H.	64	M.	Lobar pneumonia, rt. lower; middle	14,800	85	..	.....	+	Pneumococcus; Friedländer	Pneumococcus	III	Died.
35	Mrs. H.	..	F.	Bronchopneumonia, diffuse	10,600	83	..	.....	0	Pneumococcus; Friedländer	.....	IV	Recovered.
36	Miss N.	..	F.	Bronchopneumonia, diffuse	4,200	63	+	Streptococcus	+	M. catarrhalis	.....	Neg.	Recovered.
37	Mrs. E.	..	F.	Lobar pneumonia, left base	5,000	57	0	Streptococcus; M. catarrhalis	+	Streptococcus; staphylococcus	.....	..	Recovered.
38	Mrs. M.	..	F.	Lobar pneumonia, right base	11,800	81	..	.....	..	.....	.....	..	Died.
39	Baby R.	9 mos.	F.	Bronchopneumonia, diffuse	31,200	94	0	Streptococcus	0	Streptococcus M. catarrhalis	.....	..	Recovered.
40	J. M.	..	M.	Lobar pneumonia, right middle	5,000	52	+	Pneumococcus	+	Pneumococcus	Negative	III	Died.
41	F. S.	29	M.	Bronchopneumonia, diffuse	5,700	63	0	Streptococcus; Friedländer	0	Pneumococcus Friedländer	.....	..	Recovered.
42	Mr. B.	..	M.	Bronchopneumonia, diffuse	24,200	61	..	.....	..	.....	Negative	..	Died.
43	Mrs. S.	..	F.	Bronchopneumonia, diffuse	16,200	81	0	Pneumococcus; Streptococcus	0	Pneumococcus; Streptococcus	.....	II	Recovered.
44	Baby D.	..	F.	Lobar pneumonia, left lung	..	..	..	.....	..	.....	.....	..	Recovered.
45	C. A.	..	M.	Lobar pneumonia, high base	19,200	84	0	Pneumococcus; streptococcus	0	Pneumococcus	.....	IV	Recovered.
46	J. C.	35	M.	Bronchopneumonia, diffuse	7,900	75	+	Streptococcus; staphylococcus	+	Pneumococcus; M. catarrhalis	Negative	II	Recovered.
47	B. M.	..	F.	Bronchopneumonia, diffuse	9,100	69	0	Pneumococcus; streptococcus	+	Pneumococcus; staphylococcus	Negative	II	Negative.
48	A. B.	16	F.	Bronchopneumonia, diffuse	8,100	67	+	Streptococcus	+	Friedländer	.....	..	Recovered.

1. *Epistaxis* was a very frequent symptom. It was present to some extent in 64 out of 100 cases studied and in 38 out of the 49 pneumonia cases (80 per cent.). In 12 of the 64 instances of epistaxis it was marked in extent and in 4 of the patients measures had to be taken to control it. It occurred on the first day in 4 cases, on the second in 8, on the third in 21 and between the fourth and eighth in the rest of the cases.

2. *Herpes* was present in only 4 patients and in only 2 of the pneumonia cases (3.8 per cent.).

3. *Leukocytosis* was frequently low and in the cases in which counts above 20,000 were obtained it was not until three to five days of more or less consolidation had elapsed. As will be seen from the records of the blood counts on our pneumonia cases, in a number of instances the total white count remained practically normal throughout the course of the illness. Nevertheless, in the majority of cases some rise of the total white count took place with the onset of consolidation. It varied in extent and frequently was not observed until several days later. In many instances the increase in leukocytes was merely from 2000 to 5000 per c.mm.

4. *Sputum.* While blood-tinged sputum was present in 84 per cent. of the pneumonia cases, rusty and tenacious sputum was present in only 1 case.

5. *Pleuritic pains* were not conspicuous. Only 2 of the patients in this series had sufficient pain to necessitate strapping of the chest.

6. *A diffuse bronchitis* was present in 45 to 48 pneumonia patients (93.6 per cent.) and subcrepitant rales were present and persisted in both apices in twelve of the 100 cases, and in 6 per cent. of the pneumonia cases.

7. *The temperature* came down by crisis in 6 (12.5 per cent.) cases and by lysis in 42 (87.5 per cent.).

8. *Menstruation* was unaffected in the majority of cases. The amenorrhea frequently seen in cases of pneumonia was absent in the cases under our observation. In the majority of cases the menstruation was regular, but in 6 cases it appeared several days before the usual period, and was accompanied by menorrhagia.

9. *Extensive scaling* of hands and feet was seen in 2 of our pneumonia cases.

Temperature. The highest temperature observed in the 100 cases may be tabulated as follows:

Temperature.	No. of cases.
101.0° F.	12
102.0° F.	25
103.5° F.	23
104.5° F.	29
105.0° F.	8
106.0° F.	2
108.0° F.	1
	100

Duration. The length of illness in the 100 cases was as follows:

Less than 7 days	32
Between 7 and 10 days	31
" 11 and 14 "	17
" 15 and 18 "	14
Above 18 days	6
	100

Pulse. The maximum pulse-rate usually varied between 90 to 110. When a rate of above 120 persisted the outcome was generally poor. In one of our cases, a child, aged three years, a pulse-rate of 140 to 160 persisted for three days, with complete recovery. In another patient, with pneumonia, a girl, aged fourteen years, a pulse of 132 to 146, was present at irregular periods during the course of three days, also with complete recovery. In 92 per cent. of our cases in adults, however, a pulse-rate of above 120 that persisted for more than twenty-four hours proved fatal. We have not seen a single case of pneumonia in an adult recover with a pulse-rate of above 140, lasting more than four hours, unless that increase was distinctly due to some temporary excitement.

During the height of the disease no irregularities of the pulse, except *pulsus paradoxicus*, were observed. Irregularities of force and rhythm appeared, with the onset of cardiac failure or vascular paresis and proved fatal in 96 per cent. of such cases. During or after the crisis intermittences and extrasystoles were noted in 6 cases of pneumonia (12.5 per cent.).

Blood-pressure. It was below 100 systolic in 14 of the 100 cases; between 100 and 110 in 40 per cent.; between 110 and 120 in 28 per cent.; and between 120 and 140 in 18 per cent.

When the pulse-rate per minute was markedly above that of the systolic blood-pressure expressed in millimeters of mercury the outcome was generally poor, but a variation of ten to twenty points was observed, frequently with no special influence on the outcome.

On the whole the rise in the pulse-rate was a much better indication for prognosis than the fall in blood-pressure. Several of our cases that recovered had a systolic blood-pressure of 86 to 90 during the height of the disease, while a number of our cases died when the pulse-rate rose above 120 even though the systolic pressure was between 130 and 140 at the same time.

Laboratory Findings. *Blood.* One hundred and twenty-eight blood examinations were made upon 88 of the 100 cases. The hemoglobin and red-cell count showed no special changes. 128 white blood counts were made. They were below 5000 sixteen times; between 5 and 10,000 fifty-three times; between 10 and

20,000 forty-four times and above 20,000 fifteen times. In the pneumonia cases the white blood counts were as follows:

	Cases.	Per cent.
Below 10,000	20	43.6
Between 11,000 and 15,000	9	19.5
" 16,000 and 20,000	7	15.5
Above 20,000	10	21.4
	46	100.0

In the majority of the cases that were not complicated by pneumonia the white blood count was generally between 5 to 10,000. Of the 16 counts where the white blood cells were less than 5000 all but one were in uncomplicated cases. In 18 cases not included in the pneumonia tabulation the blood count was between 10 to 20,000. They were all cases of extensive bronchitis and a number of them had several areas of bronchopneumonia.

Otitis media was generally accompanied by an increase of the total white and by a rise of the polynuclears. Empyema was accompanied by a temporary increase of the white cells. If the disease was of more than one week's duration the total white count generally dropped while the polynuclears and especially the large mononuclears and transitionals became increased.

The white count did not prove of great value as a prognostic aid in our pneumonia cases. In our 12 fatal cases, 4 white counts were below 10,000, 5 between 10 and 15,000 and 3 were between 18 and 24,000. Since 20 of our pneumonia patients had a white count of less than 10,000, it would indicate a mortality of 20 per cent. of these cases, while the mortality was 25 per cent. of the series.

Differential determinations of the leukocytes were also made 128 times upon 88 of the 100 cases. The polynuclears were below 75 sixty-six times and above 75 sixty-two. The lymphocytes were below 25 eighty-three times and above 25 forty-five. The mononuclears and other elements were not altered to any noticeable extent.

Throat Smears. Throat smears were taken in 73 cases. The bacillus of influenza was found in 42 of the cases (57.5 per cent.). In the majority of cases it was found in combination with the pneumococcus, streptococcus and Micrococcus catarrhalis. In the pneumonia cases the influenza bacillus was found in 16 out of 35 cases examined (45.7 per cent.). It was in combination with the pneumococcus in 9 of these. In the rest, streptococci, staphylococci and Micrococcus catarrhalis were found.

Sputum. The Bacillus influenzæ was found in the sputum of 49 of 78 patients examined (62.8 per cent.). In our pneumonia cases the Pfeiffer bacillus was isolated from the sputum of 27 of the 41 cases examined (63.4 per cent.). In 23 of these instances the

pneumococcus was also found. In the remaining 4 cases the streptococcus and the Friedlaender bacillus were also isolated. In 37 cases uncomplicated by pneumonia the bacillus of Pfeiffer was isolated from the sputum 22 times (60 per cent.). It will hence be seen the frequency of Pfeiffer's bacillus was about the same in the pneumonias as in the uncomplicated cases.

Pneumococcus groupings were done in 30 of the pneumonia cases, with the following results:

		Per cent.
Group I	2	6.65
" II	11	36.80
" IIa	2	6.65
" III	7	23.30
" IV	8	26.60
	30	100.00

Three patients with Group II and the same number with Group III pneumococcus died, also two other patients with organisms belonging to Group IV.

Group precipitins in the urine were performed on 25 of the pneumonia patients, with the following results:

	No.	Per cent.
Group I	1	4.0
" II	8	32.0
" III	5	20.0
" IV	0	0.0
Negative	11	44.0
	25	100.0

Urine. A faint trace of albumin was found during some period of the illness in 59 of the 100 cases. It was present in 46 out of the 48 cases of pneumonia. In the majority of instances it was undoubtedly a febrile albuminuria. With the subsidence of the fever the albumin entirely disappeared. A moderate cloud of albumin was found in 16 cases, a heavy cloud in 7 and a very heavy cloud in 2 of the cases.

Occasional hyaline casts were found in 14 cases, and like the faint trace of albumin were of no special significance.

In 10 out of the 12 fatal cases there was a heavy cloud of albumin and numerous hyaline and granular casts several days prior to the termination. In some of the cases there was a marked albuminuria upon admission to the hospital, and it was therefore impossible to determine whether the albuminuria was distinctly a complication or whether the patient was suffering from chronic nephritis prior to the present illness. In 5 of the fatal cases we were able to note its first appearance. In 1 it appeared on the third day of the illness while in the other 4 it made its appearance two to four days prior to death and was accompanied by cyanosis and other signs of cardiac decompensation and vascular paresis.

Of the 16 cases in this series, with moderate clouds of albumin, 2 died (12.5 per cent.) and 14 (87.5 per cent.) recovered. The 7 cases with the heavy cloud and the 2 with the very heavy cloud all terminated fatally.

Hence it will be seen that in the series of cases that a heavy cloud of albumin and the presence of many casts were an indication of profound illness and of poor prognostic omen.

Acetone was found in 8 cases, but it was always associated with either starvation or repeated vomiting. No definite acidosis referable to disease was demonstrated in our cases. No increase of *indican* was found.

Complications. 1. Otitis media was a complication in 4 of the 100 cases. It developed rather late in all cases (tenth to eighteenth day). Two of these patients had bronchopneumonia, one lobar pneumonia and the fourth had only bronchitis.

2. Empyema was a complication in 2 cases. In one it was demonstrated on the twelfth day of the illness and in the other on the twenty-eighth. In 1 case the pneumococcus was isolated from the pus while in the other streptococcus was found.

3. Pleurisy with effusions was present in 2 cases. In both the streptococcus was found. One case ended fatally before pus formation took place. In the other spontaneous resolution took place, with an uneventful recovery.

4. Orbital cellulitis was a complication in one case. There was a very marked protrusion of the eyeball with extensive edema of both eyelids. The temperature rose to 107° F. one day, but, on the whole, the temperature was low and the pulse slow. There was no leukocytosis evident in this case from the complication. An otitis media with a profuse purulent discharge was present on the same side. The orbital cellulitis responded to constant wet dressings, with a good recovery.

5. Nephritis to a marked degree as evidenced by a heavy cloud of albumin and numerous hyaline and granular casts was found in 12 cases, 10 of which terminated fatally.

6. Pregnancy was a complication present in 7 of the cases. Two had influenza bronchitis (1 with pleurisy) and 5 had lobar pneumonia of one or more lobes. One of the patients developed influenza complicated by lobar pneumonia during the puerperium following the spontaneous miscarriage of a six months fetus. She made a slow but complete recovery. Out of the 5 patients with lobar pneumonia in the eighth month of pregnancy 4 died (80 per cent.). They all had premature labor. Two children lived and two were stillborn. The patient who recovered gave birth to a stillborn child. Both patients with the influenza bronchitis recovered. One gave birth about two weeks prematurely, while in the other case the influenza had no untoward influence upon the pregnancy.

TABLE II.—TABULATION OF THE TWELVE FATAL PNEUMONIA CASES.

No.	Name.	Age.	Sex.	Diagnosis.	Complication.	Blood-pressure.	Urine.		Sputum.		Group.	Blood.		Blood cultures.
							Albumin.	Casts.	Pfeiffer.	Other organisms.		White blood cells.	Polynuclears.	
1	D. M.	26	M.	Lobar pneumonia	.....	124/70	++	++	0	Friedländer's; M. catarrhalis; pneumococcus	III	18,700	88	Streptococcus.
2	Mat.	36	F.	Lobar pneumonia	Pregnancy	136/80	+	+	–	.....	...	11,800	81	
3	L. R.	26	F.	Lobar pneumonia	Pregnancy	100/54	+	0	+	Pneumococcus	IV	12,400	80	Pneumococcus.
4	Bos.	64	M.	Bronchopneumonia	Cardiorenal	132/74	++	++	–	.....	...	24,200	61	
5	B.	32	M.	Bronchopneumonia	Pleurisy with effusion	100/74	++	++	+	Pneumococcus; streptococcus	IV	7,800	79	Pneumococcus.
6	A.	29	F.	Lobar pneumonia	Hyperthyroid	100/64	++	+	–	.....	...	9,200	74	
7	E. G.	34	M.	Lobar pneumonia	.....	116/50	+	0	+	0	...	13,200	77	Pfeiffer's bacillus.
8	H. S.	3	F.	Lobar pneumonia	.....	...	++	+	0	Pneumococcus	III	18,200	74	Pneumococcus.
9	J. K.	48	M.	Lobar pneumonia	Nephritis	108/70	+++	++	0	Streptococcus; M. catarrhalis	...	5,000	50	
10	E.	34	F.	Lobar pneumonia	Nephritis	116/80	+++	+++	0	Pneumococcus	II	9,200	88	Pneumococcus.
11	H. H.	64	M.	Lobar pneumonia	Nephritis	140/82	+++	++	0	Pneumococcus; Friedländer's	III	14,600	82	Pneumococcus
12	J. M.	63	M.	Bronchopneumonia	Arteriosclerosis	132/84	+++	+++	+	Pneumococcus	III	5,000	52	Pneumococcus

Other complications (encephalitis, phlebitis, etc.) were seen during the epidemic, but as they were not complications of the 100 cases here considered we shall not include them in this paper.

Termination. Twelve of the 100 cases terminated fatally; all of these had pneumonia. Four of the cases were complicated by pregnancy. In 10 of the 12 fatal cases evidence of a marked nephritis was present. In 4 of the cases just mentioned a chronic nephritis was present from the onset of the present illness. In the other cases death evidently took place because of toxemia with either cardiac failure or vascular paresis. A tabulation of the fatal cases is included (Table II).

Summary. 1. One hundred consecutive cases of influenza were analyzed. Of these 48 had lobar pneumonia and 18 cases had extensive bronchitis, with several areas of bronchopneumonia.

2. Of these 100 cases studied only 2 gave a history of having had influenza during the 1918 epidemic.

3. The bacillus of Pfeiffer was isolated from the throat cultures of 57 per cent. of cases examined and in the sputum of 62 per cent. of cases.

4. In the pneumonia cases the incidence of the bacillus of Pfeiffer in the throat and sputum was about the same as in the uncomplicated cases.

5. The cases of pneumonia differed from a similar series of pneumococcus pneumonias by:

(*a*) Slow onset.
(*b*) Frequency of epistaxis.
(*c*) Infrequency of herpes.
(*d*) Infrequency of rusty sputum.
(*e*) Low leukocytosis.
(*f*) Infrequency of pleuritic pain.
(*g*) Frequency of extensive generalized bronchitis.
(*h*) Defervescence by lysis (87.5 per cent.).
(*i*) Frequency of menorrhagia.

6. Albuminuria was common in this series of cases and an abundance of albumin and casts proved fatal in the majority of instances.

7. The pulse-rate proved of better prognostic aid than the blood-pressure determinations.

8. The study of the leukocytic count did not prove of great prognostic aid.

9. The majority of our pneumonia cases were of Types II, III and IV.

10. Twelve of the 100 cases ended fatally. All had pneumonia (25 per cent. mortality).

Conclusions. The rapid mode of spread and the numerous instances in which several members in the same household were simultaneously affected justify the opinion that the infection was epidemic in character. The prostration, headache, pain in the

back, the epistaxis, the normal leukocytosis, seem to point clinically that the infections were cases of influenza or *la grippe*. The finding of the bacillus of Pfeiffer in the throat smears of 57 per cent. of cases examined and in the sputum of 62 per cent. and in the blood culture of one case add a great deal of weight to this conclusion. The study of the sputum and the blood cultures in our pneumonia cases, as also the clinical development and prognosis, lead us to the conclusion that in the majority of instances the bacillus of Pfeiffer was to a greater or lesser extent responsible for the pneumonic consolidation either by occurring in combination with the pneumococcus and allied organisms or else by leaving a *Locus minoris resistentiæ* in the lungs for the invasion of the pneumococcus and streptococcus.

REPORT OF A CASE OF EXTRADURAL AND SUBDURAL ABSCESS FOLLOWING SUPPURATING FRONTAL SINUSITIS AND OSTEOMYELITIS OF THE FRONTAL BONE.

By Joseph H. Bryan, M.D.,
WASHINGTON, D. C.

On May 6, 1919, L. McG., a fairly well-nourished boy, aged fifteen years, was seen by me in consultation with Dr. Charles L. Billard, his medical attendant, who gave me briefly the following history of the case:

"I was called to see the patient at his home in Waterford, Va., January 13, 1919. On examination I found a distinct swelling over the left front sinus, and pus was to be seen under the middle turbinate in the left nostril. The swelling in the forehead was not detected at this time, because the boy was kept in a dark room on account of the light hurting his eyes. During the previous fall and winter he had been in good health, except for some 'nasal catarrh,' and he had on several occasions complained of headaches, particularly when walking and riding his bicycle. During his present illness he has been running a temperature around 100° or 101°, and it was assumed, because of the prevalence of influenza in the neighborhood, he had an attack of this disease.

"On account of the seriousness of his condition he was brought to Washington the following day and admitted to the Episcopal Eye, Ear and Throat Hospital, and the next day, assisted by Dr. O. A. M. McKimmie, his left frontal sinus was opened. There was a large amount of pus immediately beneath the periosteum, and the anterior wall of the sinus showed a small perforation. Practically all the anterior wall of the sinus was removed, the sinus well curetted and the wound packed with gauze and drained externally. He did very well for a week or two, but there was always a large amount of puru-

lent discharge. At the end of two weeks he developed an abscess of the left upper lid. Because of the presence of this abscess, and because of the large amount of discharge, he was operated upon again January 31, 1919. The wound through the eyebrow was enlarged and the sinus thoroughly exposed. There was considerable granulation tissue present, and a sequestrum of bone was removed from the inner wall of the sinus, leaving a perforation into the cranium and exposing the dura over an area of about one-eighth of an inch.

"April 15, owing to a continuance of the discharge, he was operated upon again, with a view of finding some diseased bone that might be the cause of the continued discharge, but none was found. About this time his right maxillary sinus became infected.

"An interesting occurrence in connection with this case is the fact that after the second operation, on the second or third day, while he was being dressed, a cannula was inserted in the wound and the sinus washed out with a warm boric acid solution. No great pressure of the fluid was used, but about four hours later he complained of severe headache, numbness in the right hand, and there was some thickness of speech. In view of the fact that there was a perforation over the dura it is likely that the pressure of the irrigating fluid was the cause of the symptoms just mentioned."

On examination of the boy, on May 6, I found the whole of the left frontal region markedly swollen, pitting on pressure and bloody, purulent secretion exuding through the fistulous opening at the inner angle of the orbit. There was no headache, temperature normal and the patient expressed himself as feeling well. The situation was considered serious, notwithstanding the general condition of the patient, and another operation was advised and consented to by the parents.

He was sent to the Episcopal Eye, Ear and Throat Hospital, and on the following day, under ether anesthesia, the following operation was done: A free incision extending from the outer angle to the inner angle of the orbit, a vertical incision was then made in the median line for an inch and a half, joining the inner extremity of the previous incision. The flap thus formed of skin and periosteum was detached from the frontal bone as high as the eminence. The periosteum was not firmly attached to the bone and a large quantity of bloody pus and granulation tissue was found beneath it. As far as the eminence the bone was mottled and soft. With a sharp curette the softened bone was removed through the entire diseased area without perforating the inner table. The cavity was then packed with gauze soaked in a solution of dichloramine-T in chlorocosane and the margins of the wound left open.

The secretions were so profuse as to require fresh dressings twice a day for a week. They gradually subsided, however, and the wound commenced to show a tendency to heal. The convalescence was a long and tedious one, and it was not until the latter part of July

that the external wound was allowed to close for at least two-thirds of its extent. On account of the profuseness of the discharge that still existed the inner margin of the wound was kept open by gauze-packing. Palpation over the left half of the frontal region gave the impression of firm bony substance beneath the skin, and there was no swelling or pitting on pressure. The secretions continued to flow in considerable quantities, and at one of the dressings, in searching for some diseased bone that might be present and causing the continued discharge, the probe passed into the cranial cavity through the opening in the posterior wall of the sinus. The probe passed up to the vertex of the skull, and on withdrawal the secretions flowed more freely. No diseased bone was detected. The general condition of the patient during this period remained excellent—pulse and temperature normal—and at no time was there any headache or other cerebral symptoms. Wassermann reaction was negative.

During my vacation, in the month of August, the case was cared for by my colleague, Dr. Billard, who kept the wound open and maintained drainage.

On my return in September I found the patient's general condition good. Locally the wound had practically closed, save for the fistulous opening at the inner angle of the orbit, through which the secretions continued to flow in considerable quantity. A probe was introduced, as on a former occasion, through the opening in the posterior wall and could be passed without meeting any resistance to the vertex of the skull. A long cannula was then introduced and a thick, bloody, purulent secretion was evacuated, amounting to about six drams. This was done every other day, with the usual amount of secretion being evacuated. A roentgen-ray examination was then made with the probe *in situ*. The plate showed the probe either in the anterior frontal lobe or between the frontal lobe and skull. Unfortunately this plate has been lost and no illustration can be given. Another roentgen-ray examination was then made after injecting through the sinus opening a 10 per cent. solution of nitrate of thorium. This revealed a large abscess between the skull and the anterior frontal lobe and established the fact that we had a large extradural abscess to deal with. This is brought out very clearly in Fig. 1. Thorium proved a valuable aid in enabling us to decide between a cerebral and an extradural abscess.

September 25. Under ether anesthesia the following operation was done: A vertical incision, extending from the hair-line to the root of the nose, was made joining a transverse incision through the brow from the external to the inner angle of the orbit. The flap thus formed was detached from the bone, leaving a full exposure of the left half of the frontal bone. The periosteum was firmly adherent, and it was noted that the osteomyelitic condition had completely healed, the bone being perfectly firm, showing no degeneration in any part of the largely exposed field. A section of bone about one

inch in diameter, commencing at the median line and extending outward on a line with the eminence, was removed, exposing a large abscess sac just under the frontal bone and external to the dura. This sac was filled with a bloody, purulent secretion which, when drawn off, measured about half an ounce. The walls of the sac were quite thick and lined with granulation tissue. A fistulous tract, about two inches in length, was found extending from the sac to the inner angle of the orbit. After emptying the sac the granulations were gently removed and tincture of iodin applied to its walls. A

FIG. 1

large drainage tube was then inserted and drawn through the fistulous tract to the inner angle of the orbit and the vertical and transverse incisions closed with interrupted sutures.

A bacteriologic examination of the pus from the extradural abscess showed non-hemolytic streptococci in pure culture.

Except for several stitch abscesses in the line of the vertical incision the patient progressed rapidly and was discharged from the hospital in ten days. The abscess was drained by means of a drainage tube, the insertion of a cannula into the sac and by suction. The secretions continued quite profuse for a while, but gradually sub-

sided, and during the early part of December had apparently ceased, when the external opening was allowed to close. I saw him frequently during the remainder of this month and he always expressed himself as feeling well. As there were no local or general symptoms present when examined by me on his weekly visits, I could not but feel that the danger of a relapse had passed.

January 5, 1920. Word was received from his home in Virginia that he was ill with influenza, his physician reporting he had an acute bronchitis and a severe inflammation of the accessory sinuses. He gradually recovered from this illness and again reported for observation at my office February 14. His condition was excellent save for a general pallor of the skin, which was attributed to his recent illness, and he was directed to report again in two weeks.

February 16. An urgent message was received from his mother, saying he was very ill and she was bringing him to Washington. I saw him at six o'clock in the evening and noted the boy was critically ill, with a marked septic appearance, temperature 103°, swelling over the left frontal region and complaining of severe headache. I attempted to pass the cannula through the old opening at the inner angle of the orbit, but the parts were too thoroughly healed to admit of its passage. The following morning, his condition being no better, he was sent to the Episcopal Eye, Ear and Throat Hospital, when the following symptoms were noted: a dull apathetic expression, nystagmus of the right eye and twitching of the muscles of the face and nausea. Leukocytosis, 23,000.

Awaiting the arrival of his father the operation was deferred until 8.30 P.M., when a vertical and transverse incision was made through the lines of the previous operation and a flap detached from the whole left half of the frontal bone. The periosteum was firmly attached and the outer table of the bone was found to be healthy. The opening into the abscess sac made at the previous operation had been filled in with new bone formation. A larger segment of bone was removed, bringing into view the sac, which was filled with secretion under great tension. About half an ounce of fluid was removed. Another segment of bone was removed from the above opening to the inner angle of the orbit, bringing into view the fistulous tract leading to the extradural sac. The walls of the sac and the sinus were very thick and indurated. Some necrotic bone was removed from the inner table of the frontal bone at the opening leading to the sinus. As far as the eye could determine there was no break in the walls of the sac or of the sinus leading to it. After cleansing the sac of its contents the walls were cauterized with tincture of iodin and the sinus and sac packed with iodoform gauze, the outer third of the traverse incision sutured and the rest of the wound left open.

February 18. The patient reacted in three hours from the anesthetic, but remained for the rest of the night in a semicomatose state.

Respiration labored and at times cyanosed. Dressings moist from wound drainage. On removal of packing no secretion was present. Wound repacked with plain gauze and outer dressing applied.

February 19. Semicomatose condition continues; retains nourishment; can be temporarily aroused; apparently understands questions but cannot answer. Some loss of motion in the right arm. Wound redressed; no secretion in the sac or fistulous tract. Lumber puncture. Examination of the spinal fluid: Cell count, 370 per c.mm.; globulin; culture on blood agar, no growth. Seen in consultation with Major H. J. Hayes, U. S. Army.

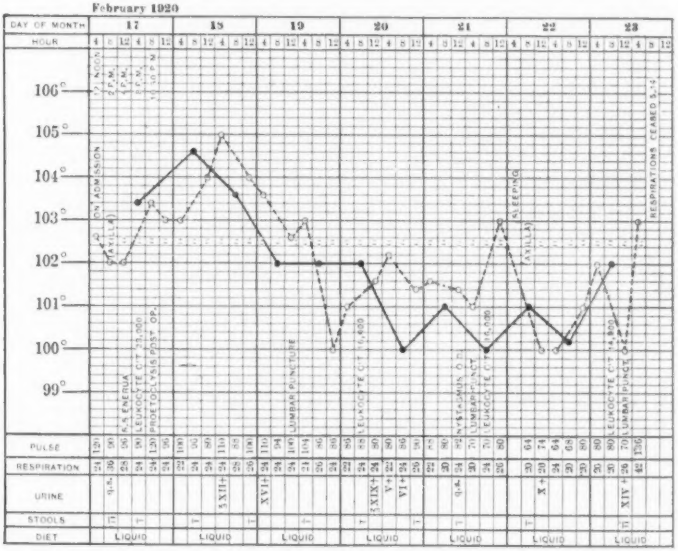

FIG. 2

February 21. Nystagmus of the right eye; twitching of the muscles of the face and mouth; evacuations involuntary. Leukocyte count, 16,000. Lumbar puncture. Examinations of spinal fluid: cell count, 49 per c.mm.; globulin; cultures on blood agar; no growth. 6.30 P.M. nystagmus of the right eye followed by facial muscular twitching, extending to the entire right side, then becoming general. Convulsions from 7 to 1 A.M. relieved by inhalations of chloroform.

February 22. Convulsions continued through the forenoon, when the patient's condition seemed to improve; more rational and taking nourishment better. No change in wound observed at dressing. Eye examination by Dr. Morrison showed nerve ends not swollen.

Veins slightly enlarged; no pressure. Both eyes in good condition. Leukocyte count, 14,000.

February 23. Convulsions, frequent during the night and in the forenoon, controlled by chloroform. Nourishment refused. Growing weaker and died at 5 P.M. For temperature, pulse and respiration see accompanying chart.

Neurologic Notes by Major H. J. Hayes, U. S. Army. The patient is in a comatose state and is unable to coöperate in the examination. The pupils are dilated following the use of a mydriatic. Extraocular movements not obtained on account of the mental condition of the patient, but there is no apparent weakness of any of the muscles of the eyes. The tongue is about in the median line and the face a trifle flattened.

Upper Extremities. Right side: There is a slight loss of power on this side. Muscle tone about normal. No atrophy and no tremors, except during convulsive seizures. Deep reflexes present and are more active than on the left side. Left-side movement is quite free in all directions. Muscle tone normal. No tremors or atrophy. Deep reflexes present but not as active as those on the right side.

Lower Extremities. Right side: Movement of good range in all directions. Muscle tone about normal. No tremors or atrophy. Deep reflexes present and about equal to those on the left side. Babinski negative. Left side: Movement good in all directions. Muscle tone about normal. No tremors or atrophy. Deep reflexes active, and about equal to those on the right side. Babinski negative. Sensory examination negative. Kernig's sign present on both sides.

From the neurologic viewpoint this patient presented several points of interest which, while well known, are of sufficient interest to record: It was noted that he was not able to call the names of objects wanted and that he misplaced words. This condition pointed to a lesion of the temporal lobe or tracts. Unfortunately the paraplesia could not be worked out on account of the patient's mental condition, but this and the convulsive seizures aided to a large extent in the localization of the pathologic process.

The convulsive seizures were of the true Jacksonian type, always starting in the facial muscles, and in a number of instances were confined to the face and forearm of the right side.

Interesting, also, is the relation of the findings in the spinal fluid to the pathology which existed. The first spinal puncture, done about six days before death, showed a cell count of 340 cells and a negative culture. Fluid examined again on the fourth day showed a cell count of 43 cells and a negative culture; and a third examination, two days before death, showed a cell count of 100 and a negative culture. While we realized a meningitis might exist for two or three days and not give more positive findings than those shown in this

case, we are quite certain that we were dealing with a process which was not in free communication with the spinal fluid. The acute condition was so rapid in progress, however, that a decompression was considered inadvisable when it was possible to recognize the condition which existed.

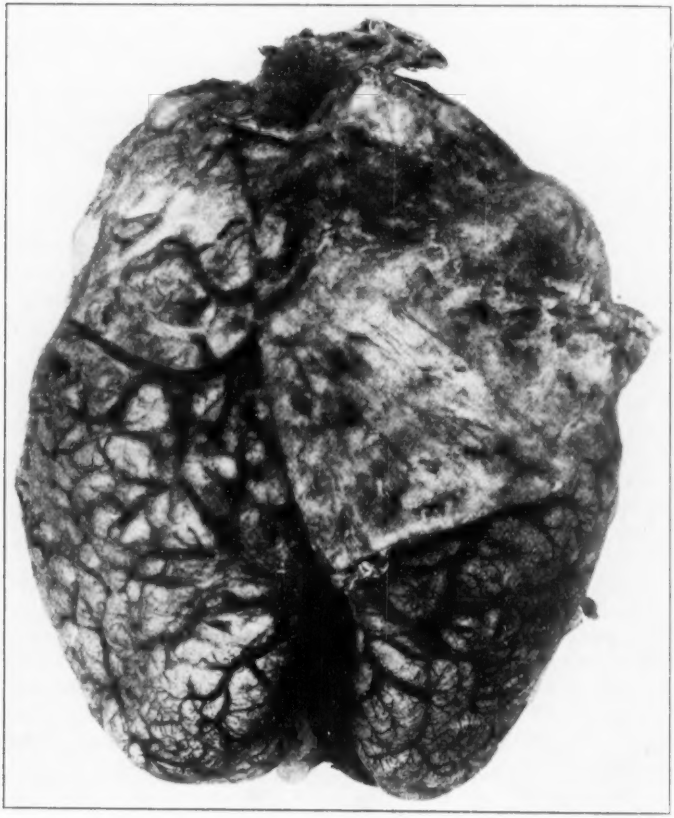

FIG. 3.—Brain. Left dural flap reflected to show under surface; depression in anterior part of left cerebrum.

Bacteriologic Report by Major Henry J. Nichols, U. S. Army. The organism found in this case has been identified as the enterococcus. This is undoubtedly the same organism that was found in the previous operation. It is widely distributed and occurs in the mouth, nose and pharynx. It is usually saphrophytic but occasionally becomes pathogenic, and cases of meningitis have been due to it as well as cases of bronchopneumonia. This case must be con-

sidered as unusual from the bacteriologic as well as from the surgical viewpoint.

The enterococcus was found frequently in the war wounds in France.

Report of Autopsy of the Head by Major George R. Callender, U. S. Army. There is an operation wound just to the left of the median line, extending from the base of the nose upward for about 8 cm. Wound includes the bone to the dura for about 5 cm. The cavity, except the bony wall, was covered by a granulating membrane.

FIG. 4.—Left hemisphere showing subdural abscess and leptomeningitis; extradural abscess sac. Operation wound tract. Dura reflected upward.

Head opened by removing V-shaped section of calvarium. Rather thick yellow pus exudes from saw cuts in the dura of the left hemisphere. Anteriorly there is a thickened area of dura, the floor of the wound cavity measuring 8 x 2 cm. The dura over the left cerebral hemisphere is thickened.

On removing the dura the entire left hemisphere is seen to be covered with a purulent exudate which, over an area roughly 8 x 5

cm., with the center at the junction of the Rolandic with the Sylvian fissure, becomes fibrinous and of a paler color. The under surface of the dura is swollen, granular and injected. The pia-arachnoid is markedly thickened, injected and swollen, obscuring the markedly injected vessels beneath.

The anterior half of the left cerebrum is flattened on the side, and where the thick fibrin forms a mass there is a depression about 1 cm. deep at its center.

The left cerebrum shows marked vascular injection, with some opacity about the vessels in the lower Rolandic area. Frontal sinus involved in operation wound. Ethmoid cells show injected mucosa. Sphenoid antrum filled with yellowish, cloudy fluid. Mucosa injected and swollen.

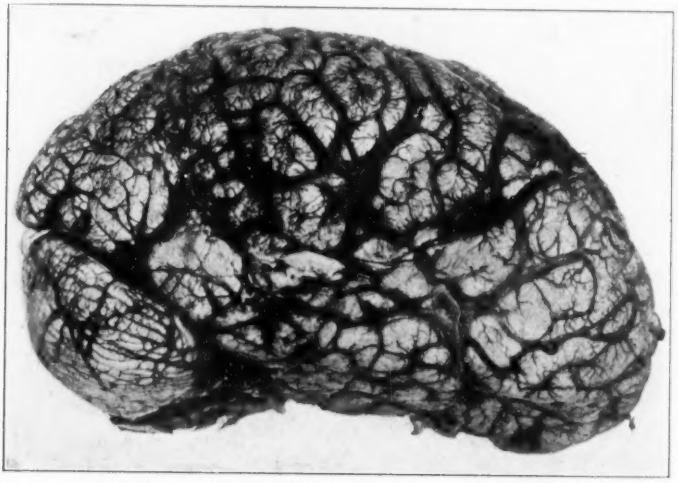

FIG. 5.—Right hemisphere; vascular injection; exudate along vessels in Rolandic area.

Streptococci in short and long chains are abundant in the exudate in and on the surface of the brain, as shown in sections.

The accompanying photographs of the brain are of considerable interest.

SUMMARY. 1. This case presents many points of interst, both from the pathologic and surgical sides, including the obstinate character of the original inflammation in the frontal sinus and the exposure of the dura in the course of one of the operations through which the infection passed to produce the extradural abscess.

2. It is unfortunate there was no bacteriologic examination made from the sinus secretion at the time of the original operation.

3. The value of nitrate of thorium as an aid in differentiating

between an extradural and a cerebral abscess during a roentgen-ray examination.

4. The complete relief of the osteomyelitis, generally a progressive condition.

5. The fulminating process developing so rapidly and resulting in a subdural abscess after the extradural abscess had seemed to be relieved.

BENIGN DECIDUAL TUMORS OF THE UTERUS.*

By John Benjamin Nichols, M.D.,
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There are a number of varieties of benign uterine polpys, some occurring in the non-pregnant uterus and some originating from the structures peculiarly associated with pregnancy. The polyps of the non-pregnant uterus are of two chief types: the mucous polyp, derived from the uterine mucosa or endometrium; the fibroid polyp, an intra-uterine fibromyoma. The gestational polyps best known are the hydatidiform, fleshy or other polyps derived from chorial structures; fibrinous polyps (or pseudopolyps), hardened masses of fibrin, perhaps mingled with placental debris, formed from blood clots retained after uterine bleeding; placental polyps, originating from adherent fragments of the placenta or fetal membranes retained after parturition. To these must be added, as shown by the observations presented in this paper, another type, the decidual polyp.

Both the fetal and the maternal elements of the placenta are capable of producing neoplasms, both malignant and benign. Of the fetal tissues the chorial structures may give rise to various benign moles and to the malignant syncytiomas and chorio-epitheliomas. The maternal portion of the after-birth, the decidua, may produce benign decidual polyps and malignant deciduomata. Tumors composed of both chorial and decidual elements conjointly are represented by the placental polyps, which are probably capable of undergoing malignant transformation.

The decidua is the structure lining the uterus during pregnancy; it originates from the uterine mucosa or endometrium, which undergoes special transformation during the period of gestation. It lies next to the muscular wall of the uterus on one side and is blended with the chorion on the other side. The decidua serotina, or placental portion of the decidua, is the thick, fleshy, deepest layer of the placenta. At the margin of the placenta the decidua serotina

* Read before the Medical Society of the District of Columbia, May 19, 1920.

continues and merges into the decidua vera, a thin membranous lamina forming the deepest of the three layers composing the membranes of the after-birth. The decidua vera attains a thickness of 8 to 10 mm. by about the fourth month of pregnancy, but later becomes thinned to about 2 mm.

Histologically two layers are distinguished as making up the decidua, a broad, deeper, "spongy" layer and a narrower, more superficial, "compact," layer. The spongy layer is composed of distended and proliferated endometrial gland structures, with an intervening stroma similar to that of the non-pregnant endometrium. The glandular hyperplasia is sometimes so marked as to resemble adenoma in appearance. In the earlier months these glands are lined with a single layer of columnar epithelium, but later this epithelium is mostly lost. The compact layer of the decidua consists largely of the so-called "decidual cells," large, rounded or oval epithelioid or endothelioid cells, with vesicular, lightly staining nuclei; at times these cells present an appearance similar to that of the prickle cells of the epidermis, with intercellular intervals crossed by fine cytoplasmic projections. These decidual cells appear in the endometrium only during pregnancy. In spite of their marked epithelioid appearance these cells are believed to originate from connective-tissue cells. The ducts of the endometrial glands traverse the compact layer during the earlier period of pregnancy but disappear after three or four months. The epithelium lining the uterine cavity in the non-pregnant period becomes in the decidua gradually thinned out and finally disappears.

The histologic elements making up the structure of decidual polyps are those of the normal decidua itself, that is, its stroma, glandular and vascular structures and decidual cells, mingled in varying proportions. An exaggeration of the tendency to glandular proliferation in the normal decidua may result in distinct, if not distinctive, adenomatous development. The stroma and glands may not, however, present an appearance essentially different from that of ordinary polyps of the non-pregnant uterus, but the presence of the characteristic epithelioid decidual cells is distinctive and conclusively indicates the decidual character and origin of the growth. Although chorial tissues (villi, etc.) necessarily develop in intimate association with the decidua, an exclusively decidual tumor should contain no or but minimal traces of chorial structures. Growths consisting of a mixture of chorial and decidual elements belong to the somewhat different and better recognized category of placental polyps.

In judging as to the character of a growth containing decidual elements it is necessary to take into consideration certain related conditions which must be differentiated or evaluated before the growth can be regarded as a true deciduoma. These conditions

are the "decidual reaction," mucous polyps, hyperplastic decidual endometritis and placental polyps.

The process of conception and early embryonic development sets into action a stimulus that results in the transformation of the non-pregnant endometrium into the gestational decidua—the "decidual reaction." This stimulus to decidua formation is effective not only at the site of implantation of the embryo but also at more distant localities. Thus the endometrium undergoes decidual development (that is, the formation of decidual cells) even in extra-uterine gestation when it is not involved in real placenta formation. Furthermore, other structures than the uterine mucosa may exhibit decidual changes, such as the development of the characteristic decidual cells. Thus in tubal and ovarian pregnancy the tissues of the tube or ovary undergo decidual transformation. Decidual changes have also been observed postmortem in the subperitoneal connective tissue of the pelvic region, as in the floor of Douglas's pouch, the lateral pelvic walls, the surface of the ovary and uterus, the pelvic colon, the omentum and the appendix; also in adenomyomata. Ley reports having seen them in the stroma of three cases of cervical erosions, being mistaken for carcinoma. He also reports a case in which polygonal decidual cells occurred in the substance of a subperitoneal fibromyoma removed at a Cesarean section; in this case the cells were regarded as derived from the muscle cells.

From these considerations it is apparent that a previously existing uterine tumor (and especially a mucous polyp, originating from the uterine mucosa) might during pregnancy conceivably undergo decidual transformation. Consequently in the case of tumors exhibiting decidual characters first observed during pregnancy or labor it is generally difficult or impossible to determine whether they originated *de novo* from the decidua during the pregnancy or were previously existing tumors manifesting the decidual reaction. A full knowledge of the previous conditions may be necessary to settle the question, and this is obviously liable to be lacking. Further systematic study of the frequent cases of uterine tumors complicating pregnancy should throw light on this question.

Decidual endometritis is an inflammation of the decidua or endometrium of the pregnant uterus, just as ordinary endometritis is inflammation of the endometrium of the non-pregnant uterus. Among the varieties of this condition, which have been long recognized, is hyperplastic decidual endometritis, which consists of an overgrowth of the decidua. This overgrowth may be either general —"endometritis decidualis hyperplastica diffusa"—or circumscribed (usually termed "polypoid")—"endometritis decidualis hyperplastica polyposa."

It is conceivable that a general thickening of the decidua might take place in connection with death of the embryo in the first weeks

of pregnancy, and hence exhibiting little fetal or chorial structure; and that this decidua might become separated and expelled from the uterus as a fleshy mass or pseudo-tumor, with a central cavity. A possible though not certain case of this kind is on record (Maier).

Again the distinction between a localized hyperplasia of the decidua and a decidual tumor might be more or less academic.

Placental polyps are intra-uterine growths originating from fragments of placenta or membranes retained after labor. Whether their development is initiated at the time of labor or antedates that time they become clinically manifest only after parturition. The symptoms indicating their occurrence (hemorrhage, malignant change, etc.) sometimes appear a very short time after labor, sometimes only after the lapse of months or years. These growths consist of a mixture in varying proportions of chorial and decidual elements, which have undergone hyperplasia and formed tumor-like masses. They necessarily must have, or at some period must have had, a decidual foundation giving them organic connection with the uterine substance. Ordinarily placental polyps probably contain a large or considerable proportion of chorial structures, but it is conceivable that with early death of the embryo, arrest or failure of development or atrophy of the chorial structures, or for other causes, only the hyperplastic decidual portion of the growth would be left with but minimal or imperceptible traces of the chorion. Such a growth might be entitled to the appellation of a decidual tumor, and yet its origin and pathologic characteristics would be identical with those of placental polyps. Decidual tumors developing subsequent to abortion or labor therefore practically belong to the category of placental polyps; at least it would be difficult to draw an absolute line of distinction between the two.

The foregoing considerations afford criteria by which we can estimate the pathologic position of decidual tumors. The observations which I shall present demonstrate the occasional, if rare, occurrence of benign uterine tumors exhibiting predominantly decidual characters and containing no (or but minimal) traces of chorial tissue. Some of these develop during the period of gestation long before parturition; these are least doubtfully entitled to the designation of true deciduomata. It seems quite conceivable that these tumors could arise *de novo* from the decidua of the pregnant uterus, and yet we are not now in a position to exclude the possibility of their being previously existing uterine polyps that have undergone the decidual reaction. Other cases of tumors of predominantly decidual structure develop subsequent to parturition, but these practically and essentially pertain to or merge into the somewhat different and better recognized category of placental polyps.

The term deciduoma malignum in strictness should denote a sarcomatous tumor originating from the mesoblastic elements of the

decidua or possibly an adenocarcinoma originating from decidual glands (if identifiable as such or distinguishable from an ordinary endometrial adenocarcinoma). The frequent use of the expression deciduoma malignum as synonymous with chorio-epithelioma is obviously a misnomer, since the latter essentially involves chorial epithelium only and not decidual elements.

I have found in the literature extraordinarily few reported cases and studies of benign deciduomata, so few as to make possible only a beginning of a casuistic and epicritic of the subject; though other observations are perhaps buried in articles on uterine tumors in general or tumors complicating pregnancy, etc., whose indexed titles are too general to afford a clue to their contents. Altogether (down to 1920) I have found only about six or seven reports of cases, covering only three or four unquestionable examples of benign decidual tumors, besides some doubtful cases. In addition to these I have had the opportunity of observing and studying two cases.

These cases can be best divided and considered in two classes: (1) Antepartum deciduomata, appearing or at least obviously developing during the period of pregnancy and prior to parturition, which are the truest type of the tumor; (2) postpartum tumors, on the order of placental polyps, which may develop after delivery or after death of the embryo from bits of retained decidua.

The details of the cases are as follows:

I. Antepartum Deciduomata. The first two cases are from my personal observation.

CASE I (from Dr. F. Yates).—Mrs. A. E., housekeeper. Previous history negative.

At the age of thirty-three years, after being married for about nine years, she became pregnant for the first time. On May 22, 1916, in about the fourth or fifth month of this pregnancy, a polyp about 1 cm. in diameter projecting from the os uteri was removed.

The substance of this tumor consisted largely of masses of large epithelioid cells—decidual cells. Mingled with them were small round cells. Thin-walled vascular channels were plentiful, and glandular elements were present, chiefly in the form of round, dilated or cystic cavities, with a thin epithelial lining. The exterior of the polyp was covered with a thin layer of low epithelium cells.

The patient aborted May 31, 1916. The placenta on gross and microscopic examination appeared normal. The mother's blood gave a negative Wassermann reaction.

The subsequent history of this patient, covering a period of four years, has been normal, and there has been no return of neoplasm.

CASE II (From Dr. G. S. Barnhart).—Mrs. E. J. B., housekeeper, aged thirty-nine years. Married about 1911. Had no children at term but two abortions occurred at about the third month, on December 8, 1914, and November 25, 1915. Hemoptysis, November 3, 1915.

Another pregnancy occurred in 1917, the last menstruation taking place July 20, 1917.

On October 9, 1917, a polypoid growth, about the size and shape of a Malaga grape, projecting like a finger tip from the cervix uteri, was removed in fragments; the growth was vascular and bled freely; uterus slightly enlarged.

On microscopic examination the tissue was shown to consist chiefly of masses of large epithelioid cells—decidual cells; they were rather loosely applied together, with slight intervals between them resembling those of prickle cells. Small round cells were scattered through the tissue and also aggregated in masses, especially at the periphery. No glandular structures were present. Bloodvessels and sinuses were rather plentiful and the periphery was hemorrhagic. The surface of the fragments showed little condensation of tissue to form a capsule. Superficial epithelium did not appear in the sections.

Examination of the uterus October 13, 1917, showed that the growth had entirely disappeared.

Quickening occurred December 5, 1918. There was no recurrence of polypoid outgrowth. On April 29, 1918, at full term occurred normal delivery of a female infant weighing seven and one-eighth pounds. The membranes showed a few gray, thickish, subchorial plaques, which microscopically were seen to be formed of aggregations of decidual cells. Similar subchorial gray plaques occurred also on the placental surface.

The puerperium was normal, the mother and child doing well. The patient has since been normal (two and a half years) and there has been no recurrence of uterine neoplasm. She has recently passed through another pregnancy, with normal delivery at full term, on May 18, 1920; placenta normal.

A case corresponding to the foregoing two cases was reported by Stolper, of Vienna, in 1902, as follows:

Case III.—A woman who had had four previous pregnancies (two of which had ended in abortion, the last abortion three years previously) consulted Stolper September 5, 1901. The last previous menstruation had been on July 19, 1901. She complained of a sensation of upward pressure, anorexia, pains in left chest and weakness. General examination was negative. Uterus retroplaced, large and soft; cervix hard, eroded. From the os protruded a polyp, about the size of a bean, its surface appearing like mucous membrane, and bleeding at the least disturbance; it was attached by a pedicle extending up above the internal os beyond the reach of the examining finger. A small piece of the growth was removed for microscopic examination, which disclosed its decidual structure and the existence of pregnancy. A few days later the patient returned, complaining of an increase of pressure and pains. He

removed the polyp, after which hemorrhage quickly ceased and the sense of pressure disappeared. Seven or eight weeks later, on October 29 (fourth month), the patient aborted, discharging a fresh fetus 14 cm. long. The placenta showed no abnormality and the membranes were complete.

The tumor, 2 cm. long and 0.5 cm. in diameter, had a lobed surface covered with necrotic tissue, blood and fibrin; in places were remains of an epithelial covering in the form of small thin protoplasmic layers with scattered nuclei but undivided into distinct cells. The substance of the tumor showed a distinct differentiation of spongy and compact portions. The superficial compact portion consisted mainly of large decidual cells, with some smaller cells interspersed, and with large vascular channels. The center of the tumor was made up of a mass of parallel gland tubes running lengthwise in the tumor, with scanty intervening small cellular elements; the epithelial lining of the gland tubes was composed of cubical cells, in many places degenerated, in other places completely lacking.

Stolper discusses whether this tumor originated from the decidua vera or was a preëxisting mucous polyp that underwent decidual transformation when the pregnancy set in and upholds the latter view of the origin of the tumor. This point will be considered later.

A case of a decidual adenoma, of quite different character from the three foregoing cases, was reported by Hitschmann (of Vienna?) in 1900.

Case IV.—A woman, aged thirty-six years, who had had a normal pregnancy in 1892, in her second pregnancy last menstruated July 24, 1897, and was delivered April 24, 1898. After delivery of the placenta bleeding continued; on introduction of the hand into the uterus a tumor surrounded by blood clots was found detached and loose in the uterine cavity. This tumor was 8 by 4 by 2.5 cm. in size and consisted mainly of a spongy or honeycomb-like mass of proliferated glandular cavities, ranging up to pea-size. The superficial portion of the tumor, covering the glandular masses, consisted of a thin layer (not over 1 mm. thick), made up largely of decidual cells and corresponding to the compact layer of a decidua. The gland cavities were lined with glandular epithelium, partly well preserved, partly partially degenerated. No chorial elements were present. The placenta and membranes showed no abnormality.

This tumor was essentially an adenoma, originating from the proliferated glandular elements of the spongy portion of the decidua and becoming detached during labor.

Hitschmann considers the possibility of this tumor having been in existence as a mucous polyp prior to the beginning of the pregnancy and undergoing decidual transformation along with the rest of the endometrium during gestation. He concludes that the tumor probably originated during the gestation.

A case of a uterine fibroid containing isolated masses of decidual

elements was reported by Melnikoff-Razvedenkoff, of Russia, in 1907, as follows:

CASE V.—A woman, aged thirty-five years, married for nine years, suffered painful and profuse menstruation, and about May, 1901, had metrorrhagia for eight weeks. A few months later she became pregnant, the last menstruation occurring September 10, 1901. She developed nephritis and dysuria, and was found to have two fibroid tumors in the uterine muscular substance, toward the peritoneal surface. Hysterectomy was performed by Michin February 6, 1902 (fifth month), with recovery from the nephritis. Five years later the patient was in good health and had developed no malignant conditions.

One of the tumors was a simple myoma, of the size of a goose egg. The other tumor, fist-sized, was of fibromyomatous substance in which were imbedded foci of decidual tissue (spongy), with decidual cells and gland structures, each focus with a little cleft-like cavity; there was also a small isolated canal-like cavity lined with cuboidal epithelium, with internal papillæ and surrounded by a muscular sheath. These foci and the canal were unconnected with one another or with the interior of the uterus, and were regarded as isolated rudimentary supernumerary uterine cavities imbedded in a fibromyoma and undergoing gestational changes simultaneously with those of the pregnant uterus. The tumor was benign.

The earliest report of cases of decidual tumors which I have found is an account of two alleged cases by Maier, of Freiburg, published in 1876. Although this author asserted that these tumors were of decidual nature his descriptions and illustrations of their histologic characters do not agree very well with those of the typical decidua; there is therefore some obscurity and doubt about the true nature of these cases. Maier's two cases were as follows:

CASE VI.—A woman in her third pregnancy, at the twenty-second to twenty-fourth week, gave birth to a fetus, with a placenta and a tumor, the tumor being delivered first, the fetus and placenta half an hour later. The tumor was 9 by 7 by 3 cm. in size, lobed and lobulated. Histologically it exhibited a reticulated or meshwork structure, the network composed of spindle-shaped cells, the cavities occupied by large cells stated to be decidual cells; both kinds of cells were regarded as being of substantially identical character, merging into one another. The cells were in contact with one another, without intercellular elements.

According to Sänger (1891) this patient died later of carcinoma uteri.

This tumor may have been, and probably was, a decidual polyp, detached at the time of labor, but the histologic description (especially in view of the later malignancy) is not convincing as to its decidual character.

CASE VII.—A woman in the forties, mother of several children, previously healthy. In the previous year she had suffered frequent bleeding during and between the menstrual periods. Examination showed the presence of a tumor protruding from the os uteri, which was removed. The tumor was 3½ to 4 cm. long, 2½ cm. in diameter; cylindrical in form and hollow, having a longitudinal central canal; the anterior wall 2 cm. thick, the posterior 2 to 4 mm. thick. The tumor had a finely porous or alveolar structure, and on squeezing small plugs of smeary material were forced out of the cavities. The framework was partly made up of connective tissue, and the cavities were occupied by large spindle and other cells regarded as decidual cells. There were small cellular tufts ("decidual" not chorial) projecting into some of the alveolar spaces.

The tumor appeared to be a cast of the uterus, formed of a thickened mucosa or decidua, which became loosened and was cast off. Its decidual character does not seem to be demonstrated by the histologic description; if decidual, it might be classed as a case of endometritis decidualis hyperplastica diffusa.

II. Postpartum Deciduomata. A case verging on the category of placental polyps reported by Klotz, of Innsbruck, in 1886–87, was as follows:

CASE VIII.—A woman, married at the age of twenty-four years, within a period of seven years had four full-term births and three miscarriages, all of normal character except that the placenta had to be removed after a premature birth in the seventh month. The last of these labors was a normal delivery at full term, the after-birth coming away completely and spontaneously. Two months after this confinement she consulted Klotz for a uterine discharge, and a careful uterine examination at this time revealed nothing abnormal except the discharge. For two years after this she menstruated regularly and normally and enjoyed complete good health. Then (at the age of thirty-three years) she had profuse uterine hemorrhages for a period of five weeks, which finally almost exsanguinated her. Examination revealed an enlarged uterus, containing an oval goose-egg sized bleeding tumor attached by a broad pedicle to the posterior uterine wall and projecting into the dilated cervical canal. Removal of the tumor resulted in a cure of the hemorrhage, and a year later she had another normal pregnancy and labor.

This tumor was of "longish, roundish" shape; dark brown-red; soft consistency; on slight pressure thick pulpy blood exuded from cut sections. It possessed a somewhat spongy structure and was composed largely of masses of large rounded cells in close apposition —indistinguishable from decidual cells. Smaller proliferating cells and round cells were also present. Numerous branching gland structures were present, lined with distinct epithelium. Large vascular sinuses, lined with endothelium and filled with blood and cellular debris, were also present, apparently interposed between the terminal arterioles and venules. The surface of the tumor was

lined with a single layer of epithelium, in places columnar, in other places flat or even a continuous layer of protoplasm (syncytial), with nuclei at regular intervals. No chorial tissue or fetal structures were present. The structure suggested that of an early decidua serotina.

As at the previous parturition the placenta had been discharged complete and an examination two months later disclosed no morphologic abnormality of the uterus, this tumor could hardly have been derived from a retained portion of secundines from a previous pregnancy. The only explanation for it available was that it resulted from an abortive pregnancy of very brief duration, in which the gestational stimulation was sufficient to cause the development of a decidua serotina, but on account of early death of the impregnated ovum not producing any fetal placental elements.

The growth might therefore be classed as an abortive placenta, with proliferation of the decidual tissue.

The following case was reported as a deciduoma by Küstner, of Jena, in 1881:

CASE IX.—A woman who between her twenty-first and fortieth years had had eight normal full-term labors, at the age of forty-two had an abortion, about eleven weeks after her last menstruation, discharging a fetal and placental mass of the size of a goose egg. This was followed by continued bleeding, necessitating operation a month later. Examination of the uterus then showed the presence of two flat bean-sized projecting masses (the thicker about 1 cm. in breadth) attached to the wall of the uterine cavity. The tumors were removed, resulting in cessation of the bleeding and recovery. Microscopic examination showed the growths to consist of a stroma of large spindle and rounded cells, in which were imbedded numerous gland tubes lined with long columnar epithelium. No superficial epithelium was found. In places, mixed with blood clots, were sparing but indubitable chorial villi. The decidual compact layer and large cells were little or not at all in evidence; but the presence of chorial villi established the gestational origin of the tumors in this case.

In 1883 Küstner reported eight additional similar cases of tumors regarded (although lacking chorial elements) as of decidual character and following known or assumed abortions. In the absence of decidual cells or chorial structures the decidual character of these cases of Küstner is not completely demonstrated, as differentiated from non-gestational endometrial growths; certainly if deciduomatous they must have originated at an extremely early period of gestation prior to the time of development of distinctive decidual structures.

Numerous cases of placental polyps are on record which it is unnecessary to cite in this connection.

From the foregoing collection of case reports may be gathered four clear cases of benign antepartal decidual tumors—one case of

an intra-uterine decidual adenoma appearing at a full-term labor (Case IV) and three cases of decidual polyps found protruding from the external os uteri in the third to fifth months of pregnancy (Cases I, II and III). Of the last three cases two aborted and one went to full term. The benign character of the growths in Cases I and II is attested by the normal subsequent histories of the women for two to four years.

The rather academic question whether these tumors developed from the decidua *de novo* during pregnancy or were polyps previously existing that underwent decidual transformation under the special conditions of gestation cannot be finally decided from the evidence available. There is nothing intrinsically improbable in the idea that a tumor could develop directly and primarily from decidual tissue, especially as the latter is such an actively growing structure. The character of the epithelial covering of the polyps may have some bearing on the question. In Case II the absence of surface epithelium would suggest that the polyp was a recent rapid outgrowth of the decidua, and therefore, like it, lacking an epithelial covering. In Case III the primitive and imperfect character of the surface epithelium would similarly suggest recent decidual origin. In Case I the more perfect and uniform character of the epithelial covering might better suggest the possibility that this was a pre-existing polyp that with the onset of pregnancy assumed decidual characters. My own impression is that these tumors can arise *de novo* from the decidua.

Summary. Tumors exhibiting decidual characteristics may develop during the period of gestation, appearing either as polpys protruding from the os or as intra-uterine tumors found at the time of parturition. Although their microscopic appearance somewhat resembles epithelioma (or endothelioma) they are strictly benign and should not lead to needless radical operation. Whether they originate from the decidua *de novo* or are previously existing tumors that have undergone decidual transformation cannot be finally stated; the former seems probable. The identification of the decidual character of such polyps is an indication of the existence of pregnancy.

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an intra-uterine decidual adenoma appearing at a full-term labor (Case IV) and three cases of decidual polyps found protruding from the external os uteri in the third to fifth months of pregnancy (Cases I, II and III). Of the last three cases two aborted and one went to full term. The benign character of the growths in Cases I and II is attested by the normal subsequent histories of the women for two to four years.

The rather academic question whether these tumors developed from the decidua *de novo* during pregnancy or were polyps previously existing that underwent decidual transformation under the special conditions of gestation cannot be finally decided from the evidence available. There is nothing intrinsically improbable in the idea that a tumor could develop directly and primarily from decidual tissue, especially as the latter is such an actively growing structure. The character of the epithelial covering of the polyps may have some bearing on the question. In Case II the absence of surface epithelium would suggest that the polyp was a recent rapid outgrowth of the decidua, and therefore, like it, lacking an epithelial covering. In Case III the primitive and imperfect character of the surface epithelium would similarly suggest recent decidual origin. In Case I the more perfect and uniform character of the epithelial covering might better suggest the possibility that this was a pre-existing polyp that with the onset of pregnancy assumed decidual characters. My own impression is that these tumors can arise *de novo* from the decidua.

Summary. Tumors exhibiting decidual characteristics may develop during the period of gestation, appearing either as polpys protruding from the os or as intra-uterine tumors found at the time of parturition. Although their microscopic appearance somewhat resembles epithelioma (or endothelioma) they are strictly benign and should not lead to needless radical operation. Whether they originate from the decidua *de novo* or are previously existing tumors that have undergone decidual transformation cannot be finally stated; the former seems probable. The identification of the decidual character of such polyps is an indication of the existence of pregnancy.

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THE HUMAN PRE-HALLUX.

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CHICAGO, ILL.

The presence of supernumerary bones in human feet has for some years been recognized by the medical profession. The frequency with which these bones occur, however, their probable origin, and, above all, the pathologic significance of their presence, are phases of the subject that have received little attention.

It is probable that all of the supernumerary bones of the feet, although occurring in such diverse anatomic positions, are attributable to the same general cause and bear the same relation to disease. In determining what this general cause may be, a detailed study of one of the supernumerary structures is of more value than a broad survey of the whole group. For this reason no attempt has been made in the present article to deal with the many supernumerary bones appearing in human feet, bones whose positions and shapes are already well known. Rather, one structure alone has been taken up with a view of determining both its cause and its significance. This structure I have termed the "human pre-hallux," a term more truly descriptive than any by which the structure has been previously designated, since in both position and form it appears to be directly homologous with the pre-hallux observed in many of the so-called "lower" animals.

The pre-hallux is the largest of the supernumerary structures appearing in human feet, and probably the most troublesome. It is far more common than is ordinarily supposed. While it is impossible to estimate the frequency of its occurrence in the sum total of feet, it is to be found in about one case in ten of the painful feet that have come under my observation. Extensive study of feet in the roentgen ray has shown it to be the real cause of many cases of foot-trouble erroneously diagnosed as "flat-foot," "broken arches" and so forth. In fact, many other forms of foot trouble, such as "rheumatism," "gout" and similar ailments, are often shown by the roentgen ray to be but the accompanying conditions of this erratic bone development.

Growing from the inner border of the scaphoid (Fig. 1), and directed downward and somewhat backward, the pre-hallux is in a position to receive much of the weight of the body, and is, accordingly, a constant point of pressure and of pain. The surrounding tissues become irritated and swollen and the owner of the foot becomes a sufferer from "gout," "rheumatism," "flat-foot" or "broken arches," according to his fancy and the reading matter that has chanced to come his way. If he seeks professional aid the treatment offered him will depend entirely upon the source of his

counsel. He may be given an arch. He may be put on a diet. He may be instructed in foot-exercises. He may be admonished to keep off his feet. He may be advised to have a "redressing." Or he may be given what he in all probability needs, a Wassermann and antispecific or tuberculin treatment, and in some cases surgical aid.

Significance of the Pre-hallux. The pre-hallux in human feet has two possible interpretations: (1) It may be regarded as an evidence of diseased and degenerate feet whose degeneracy allows old and once-atrophied structures to redevelop; or (2) it may be looked upon as Nature's normal and healthy effort to brace a rapidly abducting member and adjust it to its ever-increasing responsibility. Thus it is an open question whether the human pre-hallux is a reversion to a lower ancestral form or whether it represents a further stage in evolution and foreshadows a future, normally six-toed human foot.

FIG. 1.—Showing articulation of human pre-hallux with scaphoid.

If the first interpretation is correct the pre-hallux should appear only in association with some degenerating disease, a history of which, by sufficient thoroughness of investigation could be obtained. If the second is correct the pre-hallux-bearing foot should be a healthy, normal member, the advance agent of a more efficient human foot-type.

Again, if the first hypothesis is correct we should be able to find traces of the old "ancestral form" among the direct ancestors of the human foot, and, according to the teachings of convergent evolution, they may appear among the members of other orders and other groups as well. That these traces exist in ample measure is shown by the animal series that follows. If the second hypothesis is correct the pre-hallux, as Nature's adjustment of individual form

to function, should appear only when a similar function makes necessary a similar adjustment. Since man is the only animal who has so far perverted his feet as to make them inadequate to the duties imposed upon them, we should, in this latter case, expect to see the pre-hallux only in human feet.

My observations of pathologic conditions coexistent with the pre-hallux, as well as my original researches among the foot-structures of lower vertebrates, lead me to incline toward the former theory, namely, that the human pre-hallux signifies reversion to a lower form, brought about probably by constitutional disease.

FIG. 2.—Left hind foot of Rana montezuma.

The Pre-hallux in Lower Vertebrates. The pre-hallux, while not a congenital structure in human feet, exists normally and is congenital in the feet of many of the lower animals. There are few orders in which it does not somewhere make its appearance. Even in those orders in which it is most frequently seen, however, the pre-hallux is extremely inconstant and gives no regular history of either evolution or devolution. It appears among the amphibia, the reptilia and

the mammalia with apparent disregard of both family history and individual need, developing in some forms into a well-marked toe, remaining in others a mere nodule of bone fused with the scaphoid. It is seen in some very primitive forms; it is well-marked in some animals that are in many respects the most specialized of their kinds.

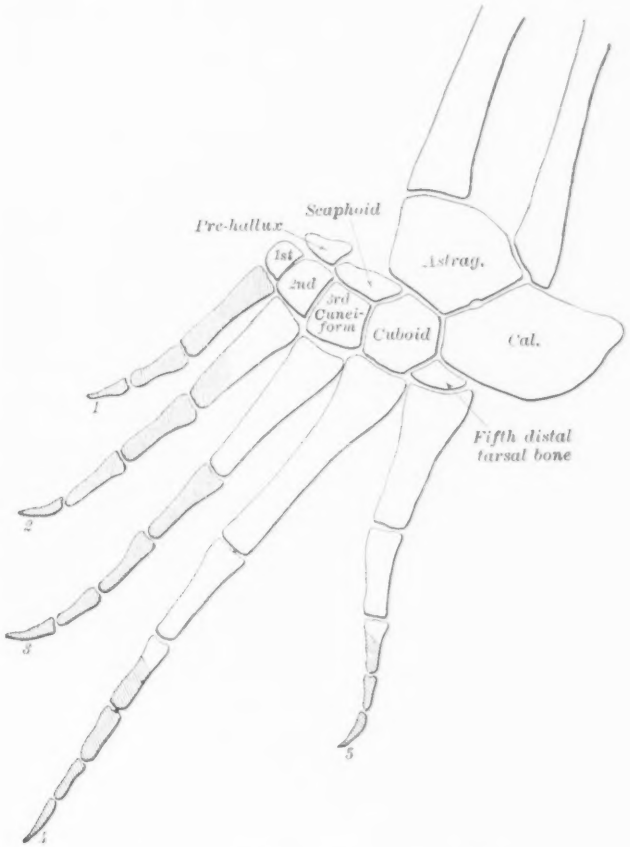

FIG. 3.—Broomia perplexia. (After Watson.)

It appears in foot-structures where it has no apparent value and fails to appear in others that would seem to most demand its presence. In short the pre-hallux even in lower vertebrate feet gives every evidence of being the remnant of some ancestral form of the past.

Just what this ancestral form may have been has yet to be discovered. Because of the lack of known links between the fins of the

fishes and the feet of the amphibians it is impossible to picture the exact stages by which the old fin-rays were fused or atrophied into the elements of the early amphibian foot. That the land-vertebrate foot, however, is but the adaptation of a fin-like appendage for weight-bearing and terrestrial locomotion has long been a generally accepted fact. The fin, therefore, being assumed the ancestor of all vertebrate feet, may be taken as the original source of all the ossification centers in such feet, and the atrophied fin-rays may be regarded as the source not only of the pre-hallux but of all the other supernumerary bones of the foot as well.

FIG. 4.—Right hind foot of echidna.

In some of the oldest known foot-structures we see a retention of the ancient elements in the pre-hallux and the fifth distal tarsal element. The eryops shows both of these elements. The eryops, although a member of the amphibia, was apparently but partially adapted to land-life and resembled in some ways some of the very ancient fishes. It is the nearest approach to a link between the fishes and the amphibians yet found.

Higher up among the amphibia we see the pre-hallux conspicu-

ously displayed in the foot of the frog (Fig. 2). The supernumerary structure is well-developed and in some species, particularly in Rana montezuma, shows two distinct segments. Thus we find the pre-hallux in both the most primitive and the most highly specialized members of this group, seeming testimony that the old ossification centers may be long-atrophied but never lost and may be indefinitely the seeds of new-bone developments.

Among the reptilia the foot of the lizard Broomia perplexia (Fig. 3) illustrates a possible type of transition between the pre-hallux of the eryops and that of later forms. A diminishing of the fifth distal tarsal element is also seen as the fifth metatarsal swings around toward the cuboid. As a matter of interest let me say that

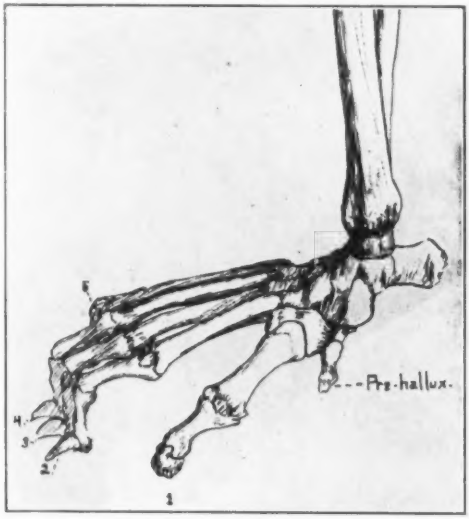

FIG. 5.—Right hind foot of opossum (didelphys).

this fifth distal element, as well as the pre-hallux, appears normally in the feet of various animals notably some of the apes, and frequently appears as a supernumerary bone in human feet.

The pre-hallux is first seen in the mammalian group in the foot of the echidna (Fig. 4), one of the two representatives of the lowest of the mammalian orders, the monotremata. The hind foot is directed backward as in some reptiles and still retains the position a fin or paddle might assume if flexed for weight-bearing and terrestrial locomotion.

In the opossum (Fig. 5) a member of the order marsupialia, the pre-hallux, is pronounced and shows variation, without apparent reason, in the number of segments it possesses. In one form it shows

two distinct segments, in another only one. In the first case the pre-hallux articulates with the internal cuneiform and in the second with the scaphoid.

In the order insectivora the pre-hallux is well-marked in the foot of the Madagascar hedgehog (Fig. 6).

The pre-hallux, even among the lower vertebrates, is not always so well-marked as it appears in the case of the opossum and the

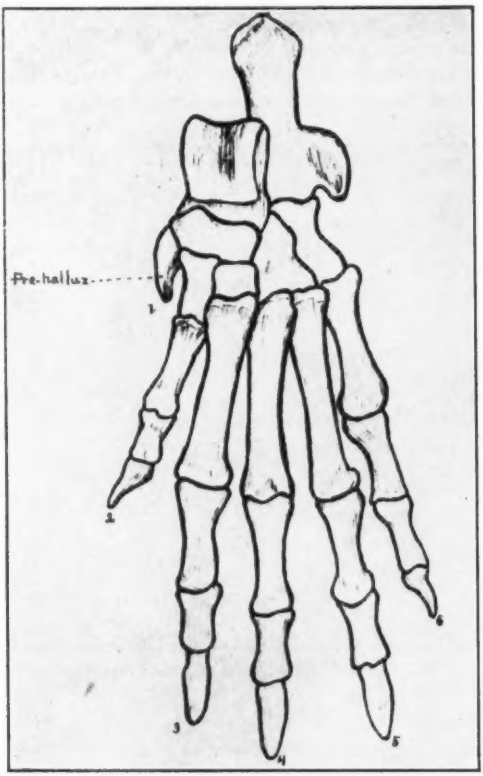

FIG. 6.—Hind foot of Madagascar hedgehog.

Madagascar hedgehog, and to other observers undertaking research along this same line a word of suggestion may not be here amiss. I have found that an already dissected foot is seldom worth anything and a mounted specimen is worth only as much as the opinion of the man who mounted it. These bones are often so inconspicuous, especially in the feet of the primates, and are so little recognized by the majority of workers, that they are simply cleaned off with

the integument and fascia and discarded as valueless. Only by dissecting the foot yourself can you find out what is really there.

Among the carnivora the pre-hallux is represented in the foot of the kinkajou (Fig. 7). In this case the pre-hallux, less well-marked than in the opossum but still of considerable size, articulates with the first metatarsal and internal cuneiform, having a ligamentous attachment with the scaphoid.

Among the primates the pre-hallux is frequently found fused with the inner border of the scaphoid. Fig. 8 shows the left foot of Cebus hypoleucus, in which the pre-hallux is in actual process of

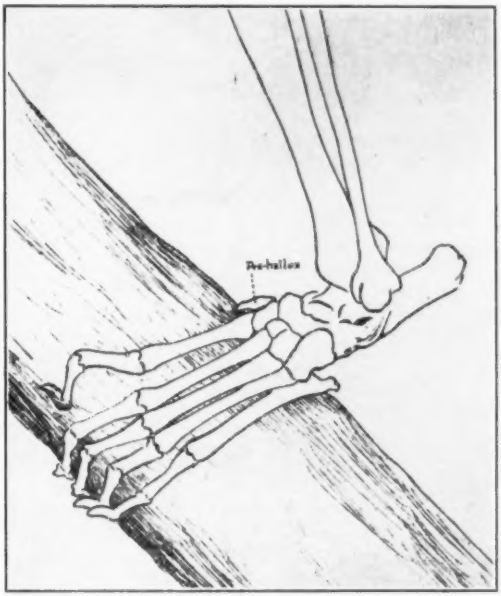

FIG. 7.—Left hind foot of kinkajou.

fusing with the scaphoid. In the right foot of the same animal the pre-hallux was still free. In both feet the suture between the pre-hallux and the scaphoid was plainly discernible.

The foot of the adult gorilla (Fig. 9) exhibits no independent pre-hallux but shows a scaphoid whose tubercle is of such size that it might well be the product of an independent ossification center.

Investigation proves that such is indeed the case. In the foot of a very young gorilla (Fig. 10), in which much of the osseous tissue of the foot is still cartilaginous, the scaphoid is seen to be the product of two ossification centers, probably the old pre-hallux and the scaphoid proper, united just above the inner border of the internal

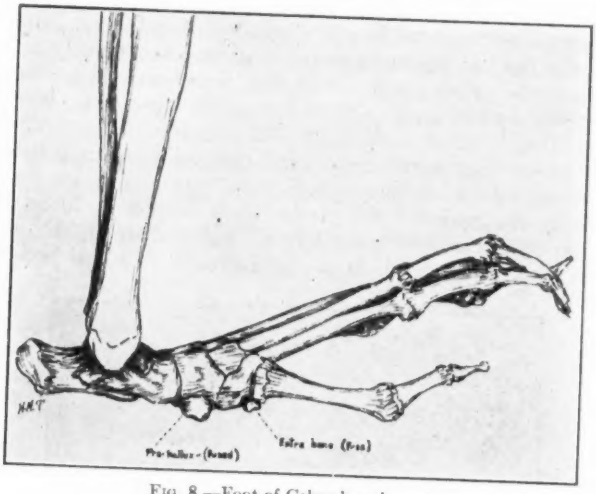

FIG. 8.—Foot of Cebus hypoleucus.

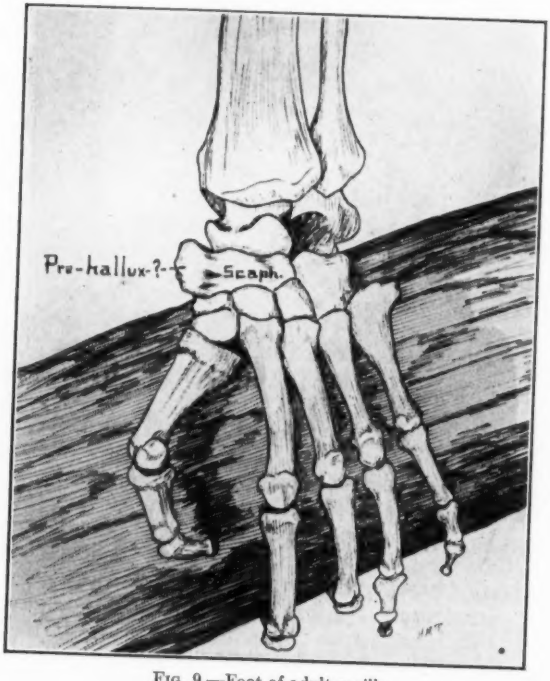

FIG. 9.—Foot of adult gorilla.

cuneiform. Thus the enlarged tubercle of the scaphoid in the adult gorilla is in reality homologous with the pre-hallux of various other forms.

Since such is the case, it seems beyond doubt that the greatly enlarged tubercle of the scaphoid in many painful human feet (Fig. 11) is also homologous with the old pre-hallux. This conclusion is further borne out by the observation of cases in which one foot shows the pre-hallux still free while the other foot shows a scaphoid much enlarged by the very apparent fusion of the pre-hallux (Fig. 12).

The foot-structures of the lower animals given above do not in any way represent the entire list of lower vertebrates in whose feet

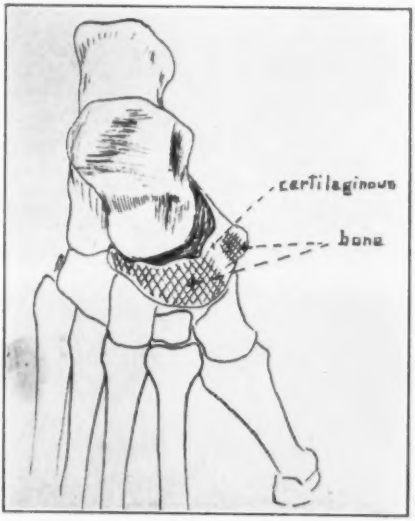

FIG. 10.—Points of ossification in scaphoid of young gorilla.

the pre-hallux is normally found. Because of the necessity for brevity I have given here only enough of the animal series to establish my point, namely, that the pre-hallux occurs normally in the feet of many of the lower vertebrates, and, in human feet, may be looked upon as a reversion.

Relation of the Human Pre-hallux to Disease. In admitting the human pre-hallux a reversion we immediately find ourselves facing another problem—the cause for this reversion. Popularly, all the supernumerary bones occurring in human feet are looked upon as accidental structures. We feel safe in asserting that Nature does not produce the same "accidental" structure again and again in the same anatomic position. When such a structure repeatedly appears

it is time to forget its "accidental" character and recognize it as the fixed and foreordered result of some fixed cause.

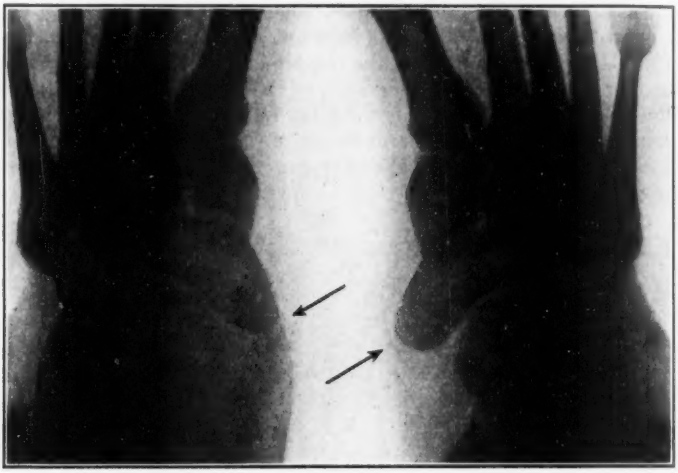

FIG. 11

FIG. 12.—Human pre-hallux fused in left foot, free in right foot.

In the case of the human pre-hallux the cause seems to be undoubtedly associated with constitutional disease. The cases under my observation give almost invariably a history of such

diseases. I have observed and photographed the pre-hallux in feet brought to operation for Charcot's disease (Fig. 13). I have

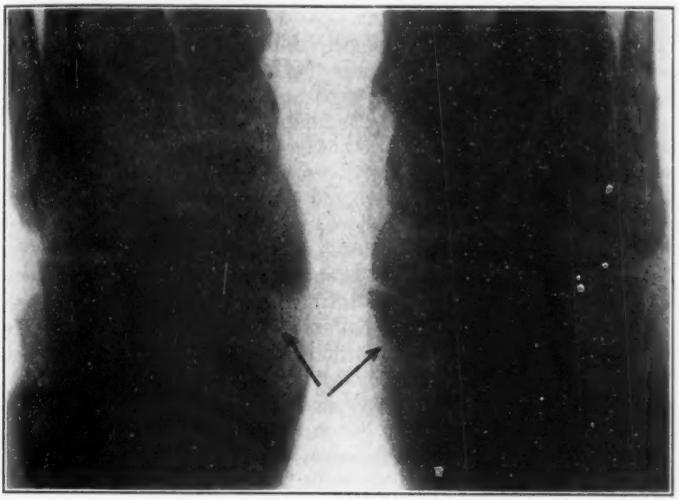

FIG. 13.—Pre-hallux in association with Charcot's disease of the proximal head of the first metatarsal.

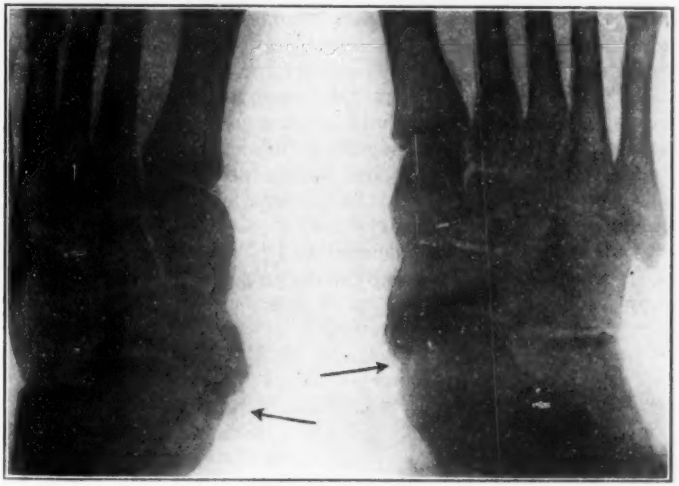

FIG. 14.—Pre-hallux in foot of tuberculous patient, a boy, aged fourteen years.

found it associated with tuberculosis (Fig. 14). I have noted its presence in feet rendered extremely painful by so-called "gonor-

rheal" spurs. While the exact cause of these spurs is still a matter of controversy, their relationship to syphilis or gonorrhea seems very probable and the presence of the pre-hallux in these same diseased feet seems of special significance.

I might go to considerable length exhibiting roentgen rays of pre-hallux-bearing feet together with the histories of the cases, but there is little to be gained therefrom. With but few exceptions—cases in most part in which I was unable to procure a satisfactory history—the pre-hallux is proved but an added affliction to an organization already overburdened with disease.

Conclusion. From its position, its time of development and its association with disease, therefore, I look upon the human pre-hallux as an evidence of foot-degeneration, a reversion to a lower form of foot-structure brought about by the devoluting influences of the constitutional diseases with which it is associated.

Summary. The human pre-hallux is that supernumerary structure growing from the inner border of the scaphoid and directed downward and somewhat backward.

It is far more common than is generally recognized, occurring in about one case of painful feet in ten.

It is the real cause of many cases of foot-trouble erroneously diagnosed as "rheumatism," "gout," "flat-foot" and "broken arches."

It is directly homologous with the pre-hallux as seen in many of the lower animals and had its ancient origin, doubtless, in some ancestral form of the past that was common to all succeeding types. Its immediate origin may be considered the dormant ossification centers left in all feet by the atrophied fin-rays.

It is not a congenital structure in human feet but appears usually between the ages of twenty and forty in association with some constitutional disease, notably syphilis or tuberculosis.

From the foregoing facts the human pre-hallux may well be looked upon as an evidence of foot-degeneration—a reversion to a lower form of foot-structure.

I wish to express my appreciation to Dr. Wm. K. Gregory, of the American Museum of Natural History, for placing at my disposal many unmounted specimens.

THE GRAVITY RESISTING ABILITY OF THE CIRCULATION; ITS MEASUREMENT AND SIGNIFICANCE (BLOOD PTOSIS).

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The estimation of the ability of the circulatory apparatus is of considerable importance, both to the physiologist and to the clinician. The heart has been studied extensively and with great care, but the balance of the circulation has not been investigated to the same degree, although modern physiology has recognized the fact that the condition of the circulatory apparatus other than the heart is of paramount importance in the variations of the blood-pressure and the distribution of the blood.

The simplest way to test the circulation is to give it a standardized amount of work to do and to note its reaction to this work, estimating what is normal and what is abnormal by the character or extent of the reaction. Exercises of various kinds have been used, such as hopping a certain distance or lifting weights of a prescribed number of pounds a standard distance at a standard rate, observing the increase in heart-rate and blood-pressure and their return to normal. The Kahn and Barringer tests are examples.

The writer has suggested[1] the use of a standardized load which may be imposed upon the circulation simply and easily and in an entirely natural manner. This consists in observing the reaction of the circulation to the hydrostatic load placed upon it when the subject rises from the horizontal to the vertical position. When the subject is lying horizontal the heart pumps blood, roughly speaking, in about the same horizontal plane and the blood returns to the heart still in this plane without having to be propelled or drawn upward to the heart. On rising to the standing position, however, the blood must return to the heart from the lower body against the attraction of gravity. It must be propelled or pushed from below or drawn from above, upward to the heart level. The mechanism for the accomplishing of this purpose consists in the contraction of the muscles of the legs upon the veins of the legs; the muscles of the abdomen contracting upon the abdominal contents and increasing the abdominal tension; the muscles of the veins themselves, particularly the splanchnic veins of the abdomen, keeping the blood from collecting therein; artificial mechanical contraction of the abdomen, such as may be obtained from belts or corsets; and the aspiration of the thorax increasing as the thorax

[1] Crampton: A Test of Condition, Med. News, September 16, 1905. Blood Ptosis, a Test of Vasomotor Efficiency, New York Med. Jour., November 8, 1913.

is enlarged by breathing or by exercise and decreasing when the thorax is allowed to relax and become smaller. This mechanism is complex and physiologists are not in accord as to the relative significance which should be attached to the tone of the splanchnic veins and the various other factors. The writer is inclined, after consultation with Professors Carl J. Wiggers, Frederick S. Lee and D. R. Hooker, to await the dissection of this phenomenon by the physiologists and for the present to consider the discharge of the series of functions which cause the blood to be returned to the heart in the vertical position as the *gravity resisting ability of the circulation*.

It has been found that this function varied strikingly with the general efficiency of the individual. It is best when the subject is at his best and poor when the subject is tired. It is usually high in good health and low in illness. It records roughly, at least (or possibly with accuracy), the variations of illness and gives promise of showing *how ill a patient is* regardless of the nature of the disease from which he suffers. It is not necessarily a symptom of disease, for it may be abruptly raised and abruptly lowered in a sensitive person by even such a common thing as a cigarette. It varies with the hour of the day and the temperature of the room, the condition of the mind, the state of the digestion and the like. It will vary like the pulse-rate slowly or rapidly, depending upon the external and internal conditions. Since these variations are many and large the writer cannot hope to present a full statement of their significance or the various values of the method of measurement. A few reports of the investigations conducted by other observers who have used this method and some selected observations by the author are, however, significant and will be given.

The Rationale of the Test. The test of the gravity resisting function of the circulation is an estimate of the efficiency of the influences which bring the blood to the heart in the upright position. These are measured in part by the rise of the systolic pressure on standing. The systolic pressure is taken rather than the diastolic, because it consists of both the diastolic pressure and the pulse-pressure: the first, an approximate measure of the tension of the arterial lake and its contents; the second, an approximate measure of the charge of blood thrown into it by the heart at each beat.

To measure the efficiency of the gravity resisting function of the circulation it would appear to be merely necessary to observe the increase in the systolic pressure or its decrease and judge accordingly.

It is true that this in itself apparently is a rough measure and may be interpreted as such. It is important, however, to recognize the fact that an increase in heart-rate *alone* will increase the systolic pressure. Therefore a rise in the systolic pressure on standing may be due in whole or in part to the increase in heart-rate. This increase in heart-rate is not an evidence of the efficiency of the gravity resisting function of the circulation, but quite to the contrary, is an

evidence of a diminution of the amount of blood given to the heart in each beat because the heart can rid itself more rapidly of the small charge than a large one. Increase in heart-rate is further evidence of an increased expenditure of effort on the part of the heart and a decrease of its nutritional efficiency on account of its decreased diastole. We have therefore come to the conclusion that the greater the increase in heart-rate on standing the less the gravity resisting efficiency.

There are therefore two elements to be taken into consideration: the increase in systolic pressure, which connotes efficiency, and the increase in heart-rate, which connotes deficiency.

The observer who wishes to get a clear picture of the circulation should note both the action of the systolic pressure and the heart-rate.

It is difficult, however, to compare two or more ratings in the same or different individuals because of the necessity of balancing the importance of these two factors. For the purpose of record, comparison and statistical handling the writer has devised a scale which balances these two influences and reads a numerical index, giving one value to consider instead of two. In constructing this scale the records of several hundred cases of normal young men were taken, and it was found that the total range of the observations (disregarding the extremes) was from plus 10 to minus 10 mm. Hg of the systolic pressure and from 0 to 44 measuring the increase in heart-rate. Finding these ranges statistically equal they were assigned equal values and each divided into fifty steps, with the fair assumption that these steps were equal in significance. This developed the original scale, which was published on the basis of normal material. Subsequently, however, records from very sick people demonstrated the necessity of extending the scale, both upward and downward, and this was done, using the same measures that had been standardized for normal material. This scale presents a useful and convenient method of stating approximately the value of the efficiency of the gravity resisting ability of the circulation.

In an earlier report the writer suggested the term "blood ptosis" and the term has since been used by Sewall.[2] This term may properly be applied to the condition of the circulation occurring when the gravity resisting ability of the circulation is low, but it should be confined to such meaning. Gravity resistance is a more fundamental term underlying the phenomenon of blood ptosis and the opposite of blood ptosis as well.

In interpreting the scale it would be advisable at the outset to relieve the mind of the notion that 100 is normal and that 0 means no gravity resistance. Such is not the case.

[2] Clinical Significance of Postural Changes in the Blood-pressures, Am. Jour. Med. Sc., December, 1919, No. 6, clviii, 573.

SCALE OF GRAVITY

(Blood Ptosis–

Blood-pressure—Increase.

Heart-rate.	50 to 49	48 to 47	46 to 45	44 to 43	42 to 41	40 to 39	38 to 37	36 to 35	34 to 33	32 to 31	30 to 29	28 to 27	26 to 25	24 to 23	22 to 21	20 to 19	18 to 17	16 to 15	14 to 13	12 to 11	10 to 9	8 to 7	6 to 5	4 to	2 to 1
Decrease.																									
− 8 to −12	215	210	205	200	195	190	185	180	175	170	165	160	155	150	145	140	135	130	125	120	115	110	105	100	95
− 4 to − 8	210	205	200	195	190	185	180	175	170	165	160	155	150	145	140	135	130	125	120	115	110	105	100	95	90
0 to − 4	205	200	195	190	185	180	175	170	165	160	155	150	145	140	135	130	125	120	115	110	105	100	95	90	85
Increase.																									
0 to 4	200	195	190	185	180	175	170	165	160	155	150	145	140	135	130	125	120	115	110	105	100	95	90	85	80
5 to 8	195	190	185	180	175	170	165	160	155	150	145	140	135	130	125	120	115	110	105	100	95	90	85	80	75
9 to 12	190	185	180	175	170	165	160	155	150	145	140	135	130	125	120	115	110	105	100	95	90	85	80	75	70
13 to 16	185	180	175	170	165	160	155	150	145	140	135	130	125	120	115	110	105	100	95	90	85	80	75	70	65
17 to 20	180	175	170	165	160	155	150	145	140	135	130	125	120	115	110	105	100	95	90	85	80	75	70	65	60
21 to 24	175	170	165	160	155	150	145	140	135	130	125	120	115	110	105	100	95	90	85	80	75	70	65	60	55
25 to 28	170	165	160	155	150	145	140	135	130	125	120	115	110	105	100	95	90	85	80	75	70	65	60	55	50
29 to 32	165	160	155	150	145	140	135	130	125	120	115	110	105	100	95	90	85	80	75	70	65	60	55	50	45
33 to 36	160	155	150	145	140	135	130	125	120	115	110	105	100	95	90	85	80	75	70	65	60	55	50	45	40
37 to 40	155	150	145	140	135	130	125	120	115	110	105	100	95	90	85	80	75	70	65	60	55	50	45	40	35
41 to 44	150	145	140	135	130	125	120	115	110	105	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30
45 to 48	145	140	135	130	125	120	115	110	105	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25
49 to 52	140	135	130	125	120	115	110	105	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20
53 to 56	135	130	125	120	115	110	105	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15
57 to 60	130	125	120	115	110	105	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10
61 to 64	125	120	115	110	105	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5
65 to 68	120	115	110	105	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5	0
69 to 72	115	110	105	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5	0	−5
73 to 76	110	105	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5	0	−5	−10
77 to 80	105	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5	0	−5	−10	−15

There are normal men and women with an index as low as 50 and abnormal cases with ratings as high as 120, just as there are normal persons with a pulse-rate from 50 to 80 and many sick persons with the same range. There is no one normal blood-pressure. A patient with arteriosclerosis that has carried a systolic pressure of 200 for several years will give us good cause for alarm when his pressure falls to 120. This is a supposedly normal record, but here it probably means the final break-down of his circulation. Similarly one must not expect to find any one gravity resistance index to be a normal. We can safely say, however, that most persons in good health show an index of from 60 to 100, that a record of over 80 in a person in poor health needs explanation and that a cause should be sought for a record below 50. A record below zero in the minus range is explicit evidence of an impaired circulation, a toxic state or acute severe physical disturbance.

Conduct of the Test. Splanchnic vasotone is measured in the following manner: The sphygmomanometer is adjusted over the brachial artery and the patient is placed on a comfortable couch

RESISTANCE VALUE.

(Crampton Value.)

Blood-pressure—Decrease.

0	1 to 2	3 to 4	5 to 6	7 to 8	9 to 10	11 to 12	13 to 14	15 to 16	17 to 18	19 to 20	21 to 22	23 to 24	25 to 26	27 to 28	29 to 30	31 to 32	33 to 34	35 to 36	37 to 38	39 to 40	41 to 42	43 to 44	45 to 46	47 to 48	49 to 50
90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5	0	− 5	− 10	− 15	− 20	− 25	− 30	− 35
85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5	0	− 5	− 10	− 15	− 20	− 25	− 30	− 35	− 40
80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5	0	− 5	− 10	− 15	− 20	− 25	− 30	− 35	− 40	− 45
75	70	65	60	55	50	45	40	35	30	25	20	15	10	5	0	− 5	− 10	− 15	− 20	− 25	− 30	− 35	− 40	− 45	− 50
70	65	60	55	50	45	40	35	30	25	20	15	10	5	0	− 5	− 10	− 15	− 20	− 25	− 30	− 35	− 40	− 45	− 50	− 55
65	60	55	50	45	40	35	30	25	20	15	10	5	0	− 5	− 10	− 15	− 20	− 25	− 30	− 35	− 40	− 45	− 50	− 55	− 60
60	55	50	45	40	35	30	25	20	15	10	5	0	− 5	− 10	− 15	− 20	− 25	− 30	− 35	− 40	− 45	− 50	− 55	− 60	− 65
55	50	45	40	35	30	25	20	15	10	5	0	− 5	− 10	− 15	− 20	− 25	− 30	− 35	− 40	− 45	− 50	− 55	− 60	− 65	− 70
50	45	40	35	30	25	20	15	10	5	0	− 5	− 10	− 15	− 20	− 25	− 30	− 35	− 40	− 45	− 50	− 55	− 60	− 65	− 70	− 75
45	40	35	30	25	20	15	10	5	0	− 5	− 10	− 15	− 20	− 25	− 30	− 35	− 40	− 45	− 50	− 55	− 60	− 65	− 70	− 75	− 80
40	35	30	25	20	15	10	5	0	− 5	− 10	− 15	− 20	− 25	− 30	− 35	− 40	− 45	− 50	− 55	− 60	− 65	− 70	− 75	− 80	− 85
35	30	25	20	15	10	5	0	− 5	− 10	− 15	− 20	− 25	− 30	− 35	− 40	− 45	− 50	− 55	− 60	− 65	− 70	− 75	− 80	− 85	− 90
30	25	20	15	10	5	0	− 5	− 10	− 15	− 20	− 25	− 30	− 35	− 40	− 45	− 50	− 55	− 60	− 65	− 70	− 75	− 80	− 85	− 90	− 95
25	20	15	10	5	0	− 5	− 10	− 15	− 20	− 25	− 30	− 35	− 40	− 45	− 50	− 55	− 60	− 65	− 70	− 75	− 80	− 85	− 90	− 95	− 100
20	15	10	5	0	− 5	− 10	− 15	− 20	− 25	− 30	− 35	− 40	− 45	− 50	− 55	− 60	− 65	− 70	− 75	− 80	− 85	− 90	− 95	− 100	− 105
15	10	5	0	− 5	− 10	− 15	− 20	− 25	− 30	− 35	− 40	− 45	− 50	− 55	− 60	− 65	− 70	− 75	− 80	− 85	− 90	− 95	− 100	− 105	− 110
10	5	0	− 5	− 10	− 15	− 20	− 25	− 30	− 35	− 40	− 45	− 50	− 55	− 60	− 65	− 70	− 75	− 80	− 85	− 90	− 95	− 100	− 105	− 110	− 115
5	0	− 5	− 10	− 15	− 20	− 25	− 30	− 35	− 40	− 45	− 50	− 55	− 60	− 65	− 70	− 75	− 80	− 85	− 90	− 95	− 100	− 105	− 110	− 115	− 120
0	− 5	− 10	− 15	− 20	− 25	− 30	− 35	− 40	− 45	− 50	− 55	− 60	− 65	− 70	− 75	− 80	− 85	− 90	− 95	− 100	− 105	− 110	− 115	− 120	− 125
− 5	− 10	− 15	− 20	− 25	− 30	− 35	− 40	− 45	− 50	− 55	− 60	− 65	− 70	− 75	− 80	− 85	− 90	− 95	− 100	− 105	− 110	− 115	− 120	− 125	− 130
− 10	− 15	− 20	− 25	− 30	− 35	− 40	− 45	− 50	− 55	− 60	− 65	− 70	− 75	− 80	− 85	− 90	− 95	− 100	− 105	− 110	− 115	− 120	− 125	− 130	− 135
− 15	− 20	− 25	− 30	− 35	− 40	− 45	− 50	− 55	− 60	− 65	− 70	− 75	− 80	− 85	− 90	− 95	− 100	− 105	− 110	− 115	− 120	− 125	− 130	− 135	− 140
− 20	− 25	− 30	− 35	− 40	− 45	− 50	− 55	− 60	− 65	− 70	− 75	− 80	− 85	− 90	− 95	− 100	− 105	− 110	− 115	− 120	− 125	− 130	− 135	− 140	− 145

with a low pillow. The heart-rate is counted by quarter minutes and a gradually decreasing rate is usually observed. Counting should continue until two successive quarter minutes are the same; this is multiplied by four and recorded. The systolic pressure is then taken preferably by auscultation. The patient stands, the heart-rate is counted as before until it reaches the "standing normal," when it is recorded, and the blood-pressure is then taken.

Examples.

Case I.—Male, aged twenty-eight years. Physical director; ex-lieutenant, U. S. Marines.

	Systolic.	Diastolic.	Pulse-rate.
Horizontal	125	81	64
Vertical	140	92	76
Difference	+15	+11	+12
Index			+105

Referring to the scale we will find a column under blood-pressure increase, the one headed by the figures 16, 15; following down this

column until we come opposite the line marked on the left of the scale 9 to 12 we find the index 105, which is the desired value for the above record.

CASE II.—Woman, aged fifty-seven years. Uterine fibroid.

	Systolic.	Diastolic.	Pulse-rate.
Horizontal	113	80	68
Vertical	130	78	68
Difference	+17	−2	0
Index			+120

CASE III.—Male, aged fifty-two years. Neurasthenic.

	Systolic.	Diastolic.	Pulse-rate
Horizontal	120	50	88
Vertical	105	55	96
Difference	−15	+5	+8
Index			+30

CASE IV.—Woman, aged forty-five years. Tuberculosis.

	Systolic.	Diastolic.	Pulse-rate.
Horizontal	108	66	90
Vertical	82	54	110
Difference	−26	−12	+20
Index			10

CASE V.—Woman, aged fifty-three years. Dementia.

	Systolic.	Diastolic.	Pulse-rate.
Horizontal	184	88	80
Vertical	100	70	82
Difference	−84	−18	+2
Index			135

These few cases are selected to illustrate the wide gamut of index value from the plus 120 to minus 135. The highest record here given (Case II) is that of a case of uterine fibroid—weak, anemic, irritable; clearly a pathologic overactivated resistance, where we would expect from other symptoms the reverse. This rare condition appears to occur most frequently where there is abdominal pain and irritation apparently nagging the sympathetic system into an abnormally active reaction to the standard physiologic load.

CASE I.—The athletic young man is simply tingling with vigor and his circulatory resistance is more than commonly active. The best boxers, wrestlers, runners and long-distance bicycle riders when in good condition show a value of from 80 to 100.

CASE III.—Is a typical neurasthenic with a typical fall in systolic pressure and a rise in pulse-rate (a little less than common),

a mild degree of blood ptosis. Neurasthenics most commonly show a record of plus 50 to minus 10.

Case IV.—Is a typical picture of the pretubercular state. These cases almost always show a systolic pressure of 100 to 110 horizontal, and a fall of from 10 to 25 mm. on standing—the diastolic also falls, but following custom, it falls less than the systolic. This class of cases usually show an index of from plus 30 to minus 30.

Case V.—This is an extreme blood ptosis indicating a profound disability of the nervous control of the circulation which curiously was structurally intact. This case was followed for some weeks and retested frequently and her indices varied from minus 80 to minus 150.

Zero and minus records are not uncommon. They may be obtained by any physician who can and will keep a very sick patient on his feet long enough to take the necessary readings. They occur, however, in ambulant cases where the circulation has become habituated to its disabilities. The lowest reading the writer has recorded is as follows:

Case VI.—Woman, aged fifty years. Diabetes.

	Systolic.	Diastolic.	Pulse-rate.
Horizontal	178	84	80
Vertical	88	50	96
Difference	−90	−26	+16
Index			165

Retest, third day after.	Systolic.	Diastolic.	Pulse-rate.
Horizontal	152	86	80
Vertical	80	58	88
Difference	−72	−28	+8
Index			110

The Gravity Resistance in Various Diseased Conditions. Gravity resistance records were taken on every patient entering the sanitarium. The average of the indices for each class of cases, with the number of cases in each class, is given in the table on p. 728.

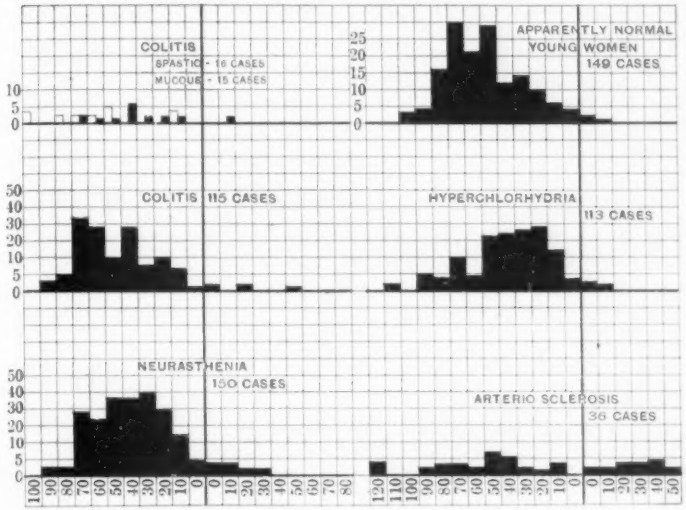
From these figures it is apparent that there is a tendency for certain diseased conditions to be associated with indices that are higher or lower than others. Differences in averages, however, grade by very easy steps from one condition to another, and it is apparent that the hopeful clinician who sees in the gravity resistance index an invariable diagnostic sign will be disappointed.

The importance of the above schedule is at present somewhat limited. The statistical method may be applied to a still larger number of cases and we may be able to state with certainty, for instance, that hyperthyroidism exhibits a standard average index of 60, while migraine shows a value of 52 and pellagra 40. This

might possibly be of importance to the practising physician, but of undoubted importance to the clinician is the fact that the index varies greatly in each diseased condition. For example, in a series of nine cases of paralysis agitans the highest index is 85, the lowest 15; of 105 neurasthenics, the highest is 90 and the lowest is − 165. We venture to suggest that these tremendous differences in circulatory function are quite as important to the physician and to the patient as the diagnosis itself, and possibly more so, for they give one indication at least of *how sick he really is.*

Number of cases.	Diseased condition or most prominent symptom.	Index.
22	Rheumatism	78.8
7	Hyperthyroidism	60.7
12	Irritability	60.7
12	Hay fever	57.0
5	Cholecystitis.	57.0
9	Dysmenorrhea	53.8
37	Obesity	53.3
6	Hypothyroidism	52.0
54	Migraine	51.9
3	Arthritis	51.0
15	Colitis (spastic)	51.0
65	Secondary anemia	49.0
17	Nephritis	49.0
12	Carcinoma	48.0
8	Cystitis	48.0
13	Hysteria	48.0
4	Gastric ulcer	48.0
11	Cystocele	47.0
20	Mitral stenosis	47.0
5	Asthma	46.0
115	Colitis	46.0
23	Hypochlorhydria	46.0
46	Asthenia	45.0
28	High blood-pressure	45.0
105	Neurasthenia	45.0
83	Hyperchlorhydria	43.0
7	Sciatica	42.0
6	Neuralgia	41.0
7	Duodenal ulcer	40.0
2	Vertigo	40.0
34	Arthritis deformans	39.0
25	Lues	39.0
25	Neuritis	39.0
15	Colitis (mucous)	38.0
54	Myocarditis	38.0
3	Pellagra	38.0
37	Arteriosclerosis	37.0
21	Mitral insufficiency	36.0
39	Insomnia	33.0
17	Pulmonary tuberculosis	33.0
12	Chronic appendicitis	31.0
8	Paralysis agitans	31.0
8	Albuminuria	28.0
24	Mental depression	25.0
2	Paresis	17.5
15	Splanchnoptosis	12.6
14	Cardiovascular renal complex	14.6
6	Angina	−3.0

A preliminary study of the distribution of the indices in disease groups, reveals the fact that in the case of some diseases there is little variation, in others there is much.



Reference to the charts will indicate that 115 neurasthenia cases are grouped closely about plus 20 to plus 70 range, while 36 arteriosclerosis cases range loosely from plus 120 to minus 50. In 115 colitis cases there appears distinct evidence of bimodality in the plotted curve, indicating the presence of two groups of colitis cases reacting differently in gravity resistance. One group centers about plus 60 and 70 and another has an indication of a mode about 40. The distribution of a few cases of colitis, one diagnosed as mucous and the other as spastic, plotted above the colitis curve, suggests the possible explanation that spastic colitis cases show a high gravity resistance and other colitis cases lower.

The distribution of cases of arteriosclerosis also suggests the inclusion of subgroups under one diagnostic head. In this case, there are three groups suggested, centering respectively at plus 120, plus 60 and minus 40. It is quite possible that there are three corresponding disease conditions coinciding with these modes. It is quite certain that those cases of arteriosclerosis with indices below zero are suffering from a severe disability of the gravity resisting forces of the circulation. It is equally clear that the four cases with indices of 120 and over have their gravity resisting forces in a hyperefficient state. The clinical significance of these striking facts is not as yet known. The foregoing is merely a preliminary entrance into a most fascinating and unworked field in medicine.

Physiologic and Other Clinical Variations of Gravity Resistance Ability. In the experience of the author, young men in good physical condition have high indices, running, as a rule, from 70 to 100. Dr. R. Tait McKenzie, of the University of Pennsylvania, reports from records taken from the University of Pennsylvania crew the average of 116 observations:

	Systolic.	Pulse-rate.
Horizontal	116.6	77.2
Vertical	115.5	85.2
Difference	−1.9	+8.0
Index		65

This index is lower than could be expected in young men prepared to enter a severe test of endurance. It reflects, however, exactly the condition of the circulation at the time. It is quite possible that men in athletic training become fatigued in circulatory control, a fact which may account for many hitherto unexplained defeats in athletic contests.

Under standardized conditions this value is an accurate indication of the "condition" of the athlete.

Mr. C. H. McCloy, instructor in physiology of exercise in a Young Men's Christian Association, and an athletic coach (reports unpublished), says that after he had standardized his athletes by establishing an initial correlation between their athletic performance and the index, it proved an exceedingly reliable measurement for the type of condition which varies from day to day.

"I could tell with fatal accuracy this individual's condition relative to his general condition at the time. If there was any doubt as to which individuals should play the basket-ball game (many thus of almost equal scale and endurance), this test was of exceeding value in determining relative condition of this individual.

"I found, furthermore, that the condition producing a high index was not only conducive to good performance, as to endurance, nervous speed and strength, but was exceedingly accurate in determining skill as well. Thus, for example, I have become somewhat able to predict accuracy and inaccuracy in basket-shooting for basket-ball players. In testing baseball pitchers I was even enabled to predict at times, with relative certainty—after I had experimented with the individual and gotten his personal equalization—about how many hits and runs would be made off of him when I knew the general ability of the other team.

"The explanation of all of this seems to me to be tied up very closely with the relationship of splanchnic tension to the present condition of the individual. The presence of fatigue poisons, results of auto-intoxication of any sort or of latent or active infection would show itself immediately in lack of splanchnic tone and power of recovery upon resuming the upright posture."

In other words, he found that though his athletes differed from each other in index, yet their variations from their own individual standards were strikingly parallel to motor efficiency of the athletic type. In my own earlier work with athletes I had the same experience, but not to the degree reported by McCloy.

Aviators have been tested at the Experimental Laboratory of the Air Service at Mineola, New York, under Major Edward C. Schneider. He has communicated to the author data (as yet unpublished), showing a striking coincidence of values and the results of various other tests. He grouped the aviators into four classes in accordance with their reaction to medical and psychologic tests, including the rebreathing low oxygen test, the rotation test, reaction time, etc., and used the author's index.

His four classes and their corresponding average gravity resistance is given as follows:

Aviation class.	Index.
AA	88.75
A	68.25
B	57.00
C (5 cases only)	68.13

Schneider also records a fall in value in 65 per cent. of cases after flying; in some cases this amounted to 30 per cent. The indices clearly suggest a correlation with physical condition.

Norris and Lane have reported a brief study of "vasotone," using our method,[3] with the following results:

	Average.	Lowest.	Highest.
Class A (10 heart cases):			
Before compensation	62.5	35.0	75.0
After compensation on getting out of bed after three or four weeks' rest and treatment	93.6	80.0	100.0
Class B (58 convalescent cases):			
On classification as convalescents after illness	45.9	10.0	67.0
After four weeks' additional treatment	81.0	40.0	100.0
Class C.:			
A group of apparently well persons	79.3	55.0	100.0

The high record 93.6 made by the heart cases after rest indicates the striking improvement in what is usually called "general condition" under treatment. It also indicates the fact that the structural and functional factors in the circulation may vary independently, and where the structural factors cannot be changed the functional may.

In a most clear-cut report of an excellently planned investigation, Smith,[4] of Los Angeles, using the author's scale, relates the "vaso-

[3] Arch. Diag., July, 1917.
[4] Jour. Am. Med. Assn., No. 3, vol. xi.

tonic" condition of a series of 500 recruits, which passed through his hands. He gives an average index of 86.9 for 500 men. He also observed low indices, plus 52, in a recruit two days before he became sick with measles and plus 92 on recovery. This recalls a case of a young athlete, found upon examination for admission to college athletics to have inexplicably low indices, and reporting sick a day or so later. The author has previously reported cases of this kind.[5] It is clear that one can only stumble on these cases occasionally in the course of routine examination. It is quite clear that a sudden drop in index may mark the *onset of acute disease before any other symptom is present.*

An interesting case that has come under the author's notice is that of a colleague at the Battle Creek Sanitarium who had been used as a subject for a study of vasotone variations.

Date.	Hour.	Feelings.	Systolic.	Diastolic.	Pulse.	Index.
Aug. 20, 1919	8.45 A.M.	Fine	H. 170	110	80	
			V. 173	108	84	
			+3	−2	+4	85
Aug. 21, 1919	9.10 A.M.	Depressed	H. 176	104	80	
			V. 168	116	84	
			−8	+12	+4	55
Aug. 22, 1919	9.30 A.M.	Good	H. 170	105	84	
			V. 180	120	84	
			+10	+15	0	100
Aug. 24, 1919	9.00 A.M.	Dizzy, nauseated and feeling ill	H. 134	80	84	
			V. 106	80	108	
			−28	0	+24	−20

This patient was sick during the day and for some time afterward with a digestive and nervous collapse. He returned to his usual range of index, 40 to 90, on recovery.

In this case it will be noted that there was an actual fall of the vertical pressure. This is not always the case, for the index may fall as the pressures rise. The same subject showed the following record:

Date.	Hour.	Feelings.	Systolic.	Diastolic.	Pulse.	Index.
Aug. 14, 1919	3.35 P.M.	Rested after nap	H. 166	110	68	
			V. 171	105	72	
			+5	−5	+4	90
Aug. 14, 1919	5.05 P.M.	Excited; "rushed"	H. 184	123	66	
			V. 180	115	66	
			−4	−8	0	65
Aug. 14, 1919	6.10 P.M.	Still rushed and excited	H. 188	115	68	
			V. 172	118	72	
			−16	+3	+4	35

[5] Med. News, op. cit.

In this instance, excitement, work and the tension of hurry raised the systolic pressure (especially the horizontal) but progressively lowered the gravity resistance. These records illustrate the fact that gravity resisting ability varies independently of the actual blood-pressures.

The index has been used by Goldberger,[6] under the writer's direction, to ascertain the effect of work days and holidays upon "vasotone." The following results were obtained:

	Number of cases.	Average change.	Greatest increase.	Greatest decrease.
Fatigue of one school day	13	−9.3	+10.0	−27.5
Recuperation over week-end	13	+1.7	+37.5	−40.0
Recuperation during Easter holidays	13	+3.6	+27.5	−37.5
Depreciation January 22 to March 25	13	−7.3	+40.0	−32.5

Recuperation, 53 cases, summer vacation, June 24 to September 15.

	Average change.
First group, nine to ten weeks spent in country	+13.7
Second group, four to eight weeks spent in country	+14.3
Third group, one to four weeks spent in country	+8.3
Fourth group, taught summer school	−20.8
Fifth group, ill during the summer	−16.7

These figures present striking pictures of the effect of rest and recuperation in contradistinction to work and illness and open a primary field of research in industry.

Another valuable research which throws light upon the effect of working conditions upon efficiency has been made by the New York State Ventilation Commission.[7] They made thirteen different physiologic records, including the index, and report as follows:

"A very high room temperature, such as 86° F., with 80 relative humidity, produces slight but distinct elevation of body temperature, an increase in reclining heart-rate, an increase in the excess of standing over reclining heart-rate, a very slight lowering of systolic blood-pressure and a marked fall in the "Crampton value."

The final summary is as follows:

Temperature.	Air.	Crampton index.
68° F.	Still	+60.0
75° F.	Still	+45.0
86° F.	Stirred by fans	+40.0
86° F.	Still	+35.0

This indicates the tonic effect of cool air and the blood ptosis producing effect of hot air, particularly when still.

Tobacco. The effect of tobacco upon the gravity resistance ability is often quite marked. A single subject was carefully stand-

[6] Teachers' Vitality as Indicated by the Blood-ptosis Test, New York Med. Jour., April 29, 1916.

[7] Some Results of the First Year's Work of the New York State Ventilation Commission, Am. Jour. Public Health, No. 2, vol. v.

ardized for a period of a week. He was thirty-five years old, in the diplomatic service of the United States, a neurasthenic and had been an occasional heavy smoker, when called upon for long-continued work. His customary gravity resistance index was +20 to +60. He had not smoked during the previous week.

	Systolic.	Diastolic.	Pulse-rate.	Index.
Room temp. 73° at 11.00 A.M.	H. 112	60	72	
	V. 106	74	100	
	−6	+14	+28	+30
Cigarette given 11.20 A.M.	H. 134	75	92	
	V. 114	80	110	
	−20	+5	+18	+5
Dizzy, asked to lie down, 11.30 A.M.	H. 114			
	V. Below 70 (by palpation. No sounds heard).			
	Patient would not or could not stand.			
	Insisted on lying down; profuse perspiration; nauseated.			

This is the clear picture of tobacco sickness and is typically a blood ptosis. Unfortunately the observer could not get the pulse-rate, or follow the systolic pressure down below 75. The index was probably between minus 60 and minus 80, and going down. The experiments were made in the bath treatment room, with the temperature at 73° and the humidity over 80. This is noteworthy, for the temperature was lowered to 57° to 60° the next day and strikingly different results were obtained, as follows:

	Systolic.	Diastolic.	Pulse-rate.	Index.
11.00 A.M., temp. 57°	H. 132	84	72	
	V. 134	86	72	
	+2	+2	0	80.0
11.13, lit cigarette	...	...	78	
11.13½	...	...	88	
11.14½	...	...	92	
11.15½	H. 146	90	96	
	V. 170	104	96	
	+24	+14	0	135.0
11.21	H. 148	90	88	
	V. 162	98	88	
	+14	+8	0	110.0

The resistance was quite high, (80) before smoking, due to the temperature effect, quite in accord with the New York State Ventilation Commission findings. Under this stimulus the cigarettes acted

very differently from the day before. The systolic pressure, 20 points higher than the day before to begin with, rose abruptly 14 mm. in the horizontal position and 26 in the vertical, with both diastolic pressures and pulse-rates increasing, whereas, under the hot, heavy, humid atmosphere of the day before, the bottom literally dropped out of the pressures. This experiment, although unrepeated, is reported because of its striking demonstration of variations in gravity resisting ability. It is, of course, only a single case and should be evaluated as such. It is submitted in the hope that others may be in a position to make similar tests.

In the opinion of the writer the subject was sensitized to the effect of tobacco because of his previous overindulgence and had developed a tolerance to its toxic effects. This tolerance was broken down by the removal of its customary stimulation and left the system peculiarly sensitive to the effect of the tobacco.

RECORDS BEFORE AND AFTER TONSILLECTOMY.

		Number of days after operation.				
Case No.	Before operation.	1	2	3	4	5
I	70	55	50	50	60	
II	85	25	20	65	80	75
III	105	60	..	..	..	60
IV	40	50	40	55	50	
V	55	45	30			
VI	50	35	50			
VII	75	90	75	50	55	80
VIII	30	20	40	25	35	30
IX	80	95	60	30	30	20
X	75	55	70	80	90	
Average	66.5	53	48.3	50.7	57.4	53.0

These few cases show certain points of interest. The average show a decrease after operation, the lowest point resting on the second day. The reaction of individuals varies. Cases IV, VI and VIII were low and lost little in circulatory power. The highest records, notably Cases II and III, lost the most. Two cases (VII and IX) actually increased in resistance power only to fall to low records on the third day. Case VII recovers on the fifth day while Case IX continues low. It is of interest to note that he suffered from kidney disease and was sick enough to be returned to the hospital on the fifth day (with an index of 20) for further treatment.

There have appeared in medical reports from time to time, in medical literature, various statements as to the reaction of the blood-pressures on rising from the horizontal to the vertical position. For example: "The systolic always falls on 'rising;'" "the diastolic always rises on standing;" "the pulse pressure always decreases on rising from the horizontal to the vertical." The action of the systolic pressure and the reasons for the action are discussed in this

communication. The bare facts from over seven hundred cases are given below:

EFFECT OF RISING FROM HORIZONTAL TO VERTICAL POSITION.
Patients entering the Battle Creek Sanitarium.

	Number of cases.	Per cent.	Total cases.
Diastolic:			
Rises	403	54	
Falls	336	46	739
Systolic:			
Rises	109	15	
Falls	639	85	739
Systolic rises; diastolic rises	83	11	
Systolic rises; diastolic falls	26	4	
Systolic falls; diastolic rises	320	43	
Systolic falls; diastolic falls	310	42	739
Pulse-pressure increases	78	11	
Pulse-pressure remains the same	70	9	
Pulse-pressure decreases	593	80	741

These figures will hold true for this class of cases. The proportions will vary from these standards in every group of cases studied, depending on the degree of illness and its nature.

Summary. 1. The horizontal and vertical blood-pressures may differ greatly in the same individual.

2. A rise in systolic pressure on standing indicates efficiency in the gravity resisting ability of the circulation; a fall, the reverse.

3. The increase in heart-rate on standing indicates inefficiency in the gravity resisting ability of the circulation in proportion to the increase.

4. Taking both influences into consideration, an index may be determined for convenient use.

5. This index is lowered by various influences among which are fatigue, toxins, the approach of disease and disease itself.

6. This index may be high in good health and also in some diseased conditions.

7. The index may prove helpful in estimating the extent illness is damaging the circulation in the course of disease and in estimating the progress of recovery.

8. This index may indicate the fatigue and the variations of condition in an athlete.

9. The normal range of this value is approximately from 50 to 100, although records in this range may be given by sick persons, but high records in sick persons are probably evidences of pathologic overtone.

10. Records below zero are evidences of great lack of circulatory power.

11. Comparison of records of two individuals may or may not

give much information. Successive records on the same case may give more.

12. The customary single recording of the blood-pressure in one position gives no information as to the gravity resisting function of the circulation.

PERNICIOUS ANEMIA: A STUDY OF ONE HUNDRED AND FORTY-EIGHT CASES.

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The study embraces a total of 148 cases discharged from the Cook County Hospital under the diagnosis of pernicious anemia, which may be divided into two main groups: (1) those in which the diagnosis was purely clinical, and (2) those in which the diagnosis was confirmed or corrected at autopsy. There were 22 of these latter. Of the other cases, 126 in number, 112 may be accepted, on the basis of the clinical study, as pernicious anemia; another group of 14 cases is made up of those which were discharged, with a question as to the diagnosis. Of the 112 cases accepted as clinically pernicious anemia, 26 will be discussed as a separate group, since they presented, as a major manifestation, the important group of symptoms denoting involvement of the spinal cord. There are therefore, 86 cases left to be studied as cases typical of pernicious anemia.

Certain features, however, may best be discussed with reference to their occurrence on the basis of the total figures. Of the total number of cases, 134 in number, clinically regarded as pernicious anemia, 94 occurred in males and 40 in females, an incidence of 70 per cent. and 30 per cent. respectively. Of the 134 cases, 67 died in the hospital, 67 left the hospital: some of them no better, many improved and a few recorded as worse and leaving at their own request. The number of histories actually studied was 161; nine of the patients had records of two periods in the hospital and two each had three histories. The histories used covered a period from 1912 to the present time. Seven of the patients were under thirty years of age; 31 were between thirty and forty; 39 were between forty and fifty; 36 between fifty and sixty; 35 over sixty. Only 6 of the cases occurred in negroes; evidently the incidence of the disease in negroes is low; the percentage occurrence here is slightly under 5; it is safe to assume that the percentage of negro patients in the County Hospital is at least twice this figure. So far as statements could be obtained the disease had lasted, prior to admission to the hospital, less than six months in 28 cases, between six months and two years in 40 cases and more than two years in 34 cases.

We will consider first the 86 cases, diagnosed as pernicious anemia, in which there were no cord symptoms or in which such symptoms were minor. A few symptoms were repeated with monotonous regularity. The symptoms of onset, as described upon the patient's admission to the hospital, may be listed as follows: Weakness, progressive in character, was mentioned 66 times; dyspnea, especially marked on exertion, 43 times; edema of the feet, in most cases worse at night, 34 times; gastric disturbances were frequent; vomiting, which occurred in 32 cases, was characterized by the absence of any regularity or relation to the taking of food; in some patients vomiting had occurred at rather long intervals and persisted for several days at a time; others would vomit "everything they ate" for weeks at a time, and others, now and then, without any apparent cause; in 10 of the cases it was stated that no blood had been vomited; in only 1 was there a history of bloody vomitus; and 20 patients expressly stated that no vomiting had occurred. Two reported themselves as very hungry; in 13 the appetite was good and 30 others made complaints of various degrees of absence of appetite. Sixteen complained of a fulness or dull pain in the abdomen; in 4 cases this was aggravated by eating. In 17 the bowels had been regular; in 17 there was constipation; in 12 diarrhea and in 4 an alternating constipation and diarrhea. Loss of weight was mentioned 26 times; in 24 of these a definite figure was given; the average loss of weight was thirty-two pounds; in 8 cases it had amounted to more than forty pounds. Dizziness was a symptom in 20 cases; palpitation of the heart in 16; headache in 13. Numbness, with or without coldness of the extremities, was an early symptom in 19 cases; cramps and shooting or dull pains in the legs were noted 6 times. The pallor was only mentioned 10 times, and in only 3 cases did the patient speak of the yellow color of the skin. Double vision had occurred once; other infrequent nervous symptoms were drowsiness, tinnitus, nervousness, irritability and insomnia. Only 3 patients gave a history of fainting. Epistaxis was mentioned 6 times; hemoptysis in 2 other cases. A sore-mouth occurred in only 4 cases. Fourteen complained of cough and 6 of night-sweats.

One patient stated that his mother had died of pernicious anemia; there was nothing of importance in the family or personal histories nor any evidence of relationship to past diseases.

On physical examination the "lemon yellow" color of the skin was noted 36 times; "jaundice," 8. Whether or not the yellowish color was incorrectly interpreted as "jaundice" cannot be said. In every instance the pallor of the skin, mucous membrane and scleræ was noted. Carious teeth were mentioned 32 times and pyorrhea 19; while atrophy of the lingual papillæ was only mentioned twice. It seems likely that the oral and lingual mucous membrane was not carefully examined. The cardiac findings were of special interest;

systolic murmurs were noted at the apex alone in 25 cases; at the base alone in 8 and at both base and apex, or over the entire precordium, in 21—a total of 54 cases. To these must be added 3 cases in which a presystolic murmur was described at the apex; another with a presystolic thrill and murmur and a systolic murmur at the apex; another with a diastolic murmur at the base (in which an autopsy one year later showed no organic cause for the murmur); another with a systolic at the apex and a diastolic along the left border of the sternum; a total of 60 cases which showed cardiac murmurs. The presence of a murmur may be regarded as one of the most constant findings of pernicious anemia. In this series it was present in 70 per cent. of the cases. Cardiac irregularities were uncommon—only 3 were described; these were probably of the type known as premature ventricular contractions. The cardiac outlines were recorded 36 times; in 28 of these the area of cardiac dulness was increased. Dilatation as a finding in pernicious anemia is equally as common as the presence of murmurs. The blood-pressure estimation varied from a systolic of 84 to one of 176; of 55 readings only 5 were above 150; 32 were below 115, 10 of these below 100. In view of the fact that the disease is one of adult life, it may be concluded that a low blood-pressure is the rule, and a blood-pressure higher than the normal for the age is an unusual finding in a case of essential anemia. The diastolic pressure varied from 40 to 90; of 50 readings, 35 were below 70; the average pulse-pressure was 53. We can regard the blood-pressure of pernicious anemia as characterized by a low systolic reading, a disproportionately low diastolic and an unusually high pulse-pressure.

The liver was palpable in 35 cases; 10 times it was stated to be as much as three finger-breadths below the costal arch; the spleen was palpated 19 times; general adenopathy was recorded but 4 times. Edema of the extremities was noted 23 times; extensive edema 4 times. The pulmonary findings were negligible; in 7 cases subcrepitant rales over both bases posteriorly were described; in 2 cases "coarse rales throughout the chest;" in another, dulness with increased tactile and vocal fremitus over both apices. A few cases presented the findings of old healed apical tuberculosis.

In 23 cases the temperature was never over 99; in 32 it usually ran from 99 to 100; in 12 from 100 to 101; in 8 over 101 at least once; this does not include some cases with terminal temperature; of 75 cases, fever was present at some time in 52. The pulse was frequently 100 or over in 29 cases. The pupils were noted as being normal in 77 cases; in 7 they reacted normally but showed irregularity or inequality. Only 2 of the patients had epistaxis while in the hospital. The reflexes were noted as normal in 57 cases; in 3 they were exaggerated; in 7 the patellar and Achilles reflexes were absent; in 1 other the patellar was absent on one side.

Sputum examinations were made in 10 cases; all were negative

for tubercle bacilli. For the other laboratory findings, aside from the blood counts, we will give the figures from the total of cases diagnosed during life as pernicious anemia without qualification, 134 in number. The Wassermann test on the blood is recorded for 46 cases; 42 were negative, 3 were 4+ positive, another, 1+. The test on the spinal fluid was negative 14 times. Gastric analyses were recorded in 57 cases; 53 of these showed no free HCl; 1, a free HCl of 2; 2 others of 7; the other case showed so much blood that acidity could not be tested for; of the 56 cases tested, 29 showed a total acidity under 10, 21 between 10 and 20, and 6 over 20. In 93 per cent. of the cases examined the stomach contents showed no free HCl; the achylia is obviously an important clinical symptom of pernicious anemia. Of 53 urine examinations taken at random 37 showed a specific gravity of less than 1015; 24-hour specimens from 8 patients showed a total of more than 1500 c.c. in 7 instances; in the other the amount was 350 c.c. The urine was otherwise negative in 41 cases. Albumin was present without casts in 7 instances; with hyaline and granular casts in 2; a few hyaline casts were noted twice; a few red cells in the remaining case. We believe these conclusions are warranted: The usual urine of pernicious anemia is increased in amount and of a low specific gravity; albumin is not often found and the constant presence of albumin and casts makes the case questionable, speaks against the diagnosis of pernicious anemia and for the existence of a nephritis as the fundamental disease producing the anemia. Ophthalmoscopic examination was recorded 17 times; in 2 instances the eye-grounds were negative; in 6 there were hemorrhages; in 3 the disk was "hazy;" the eye-grounds were noted as pale 5 times; there was bilateral "beginning optic atrophy" once. In 45 cases examinations of feces were made; in 24 of these search was made for ova or parasites but none were found, and all the examinations were negative for pus and blood.

We come now to a consideration of the blood counts. The lowest erythrocyte count was 320,000. There were in all 6 patients with red counts below 500,000; 2 of these recovered sufficiently to leave the hospital. Thirty-six patients had erythrocyte counts below 1,000,000; 19 of these improved sufficiently to leave the hospital; thus the percentage of deaths in the hospital was 47. The patients with erythrocyte counts of 1,000,000 or above numbered 50; of these 14 died in the hospital, a mortality of 28 per cent. The prognosis is made decidedly worse as the red cells diminish. Only 8 of the cases had initial counts of more than 2,000,000; in this group there were 2 deaths; 1 occurred after a profuse hemorrhage from the nose and mouth; the second case had been admitted to the hospital with a history of hemorrhages from the nose, stomach and bowels; his color index was 0.5; no hemorrhages were noted in the hospital but he failed rapidly. The color-index was 1+ in 74 cases and below 1 in 12. Nucleated red cells were described in 31 cases.

The highest leukocyte count was 30,000; in this case there had been pain over the upper sternum for one month; this was intermittent and worse on exertion; there was swelling of the abdomen; hemorrhoids were present; there were nausea and vomiting, especially in the morning; the color-index was 0.83; this case was distinctly questionable. The next highest white count was 13,900; only 3 counts over 10,000 occurred; there were 41 counts below 5000, a percentage of 45, and 16 of 3000 or below; the lowest count was 1100. In 24 cases there was a distinct relative lymphocytosis; in 23 the differential white count was normal; in 39 it was not noted. Thus when a differential count was made a relative lymphocytosis was present in a majority. The conclusion seems justified that pernicious anemia is characterized by a low white count, with a tendency to a leukopenia and a relative lymphocytosis. Fourteen cases, or 58 per cent., of relative lymphocytosis occurred among the 36 cases in the group characterized by red counts of less than 1,000,000; 7, or 50 per cent., of these died. It seems that the appearance of this relative lymphocytosis is of grave prognostic import; only 2 of these 14 cases showed total counts over 6000; the condition really signifies an absolute decrease of the polymorphonuclears, which is significant of failure on the part of the blood-making organs to meet the constant and excessive demands on their function.

A few cases deserve special mention in our consideration of the blood counts:

F. G., aged thirty-two years, was in the hospital from June 1 to September 11, 1915 On admission his blood examination showed hemoglobin 22, erythrocytes 990,000, leukocytes 3150; all the pathologic forms of erythrocytes were present. August 30 examination showed hemoglobin 75, erythrocytes, 4,640,000, leukocytes 8200, and a few poikilocytes. He had been treated with dilute hydrochloric acid, sodium cacodylate and enemata of normal salt solution, 1 gallon every morning.

H. O., aged fifty-six years, was admitted to the hospital June 13, 1914. He was irrational and very sick. Blood examination showed 560,000 erythrocytes, 6200 leukocytes, color-index 2, small lymphocytes 44, large lymphocytes 10, polymorphonuclears 42. All forms of pathologic reds were present. She was discharged July 25, 1914, at which time the examination showed 80 per cent. hemoglobin, 4,040,000 erythrocytes and color-index 1. The stained specimen was normal. She was treated with Fowler's solution.

A somewhat similar case was that of W. C., aged forty-two years, admitted to the hospital May 6, 1916, and discharged July 3, 1916. On examination his blood showed hemoglobin 26, erythrocytes 792,000, leukocytes 4700, small lymphocytes 50, polymorphonuclears 50. On discharge his hemoglobin was 80, erythrocytes 4,032,000, leukocytes 4000, small lymphocytes 28, large lymphocytes 10, polymorphonuclears 48, eosinophiles 6, transitionals 7, myelocyte one.

The treatment consisted of Fowler's solution and sodium cacodylate. In December of the same year he came under our observation at Mercy Hospital. He was once more in poor condition and died there a few days after an injection of neodiarsenol.

R. M., aged thirty-six years, was admitted to the hospital September 15, 1915, and discharged December 27, 1915. On admission his blood showed hemoglobin 15, erythrocytes 496,000, leukocytes 4100, small lymphocytes 56, large lymphocytes 2, polymorphonuclears 38, eosinophiles 2, one transitional and one myelocyte. All pathologic forms of erythrocytes were present. At discharge his hemoglobin was 60, erythrocytes 4,120,000, leukocytes 8000, small lymphocytes 12, large lymphocytes 3, polymorphonuclears 82, a few poikilocytes. The treatment consisted of dilute hydrochloric acid, sodium cacodylate, Fowler's solution and normal saline flushings, 1 gallon every other day. He was readmitted to the hospital the following summer and his fortune was not so good. He died in September. The autopsy report dated September 23, 1916, reads: "Lemon-yellow discoloration of the subcutaneous fatty tissues of the body; edema of the pannicular adiposis and the mediastinal fatty tissues and of the renal fatty capsules; marked systemic anemia; marked hyperplasia of the spleen; 'red' bone-marrow; marked fatty changes in the myocardium, liver and kidneys; dilatation of the mitral and tricuspid rings; fatty changes in the intima of the coat of the aorta; passive hyperemia of lungs and liver."

In estimating the results of treatment such experiences as these are of great value. In a disease characterized by remissions such as have just been described it is easy to be oversanguine about the results of any treatment which may be employed.

In the group of 26 cases characterized by the predominance of nervous symptoms there were 19 males and 7 females. Only one patient was under forty; evidently the spinal-cord lesions are more liable to occur in older patients. The usual development of the symptoms might be summarized as follows: After a period during which the patient suffered from various disturbances of sensation, with or without a weakness of the legs, out of proportion to the general symptoms, incoördination or ataxia would supervene. Five of the 26 cases had urinary incontinence and 4 more had both urinary and rectal loss of control. The paralysis of the lower extremities was noted as flaccid 4 times; in 5 cases there was a spastic paralysis. The ocular reflexes were normal 22 times; in 2 cases there were Argyll-Robertson pupils; in another the pupils were noted as sluggish; in the other the right pupil was irregular and did not react to light. The patellars were absent 12 times and exaggerated 9. There was a Babinski in 12 cases. An ankle-clonus was seen 3 times. In 3 cases all the reflexes, biceps, triceps, patellar and Achilles were exaggerated. The abdominal reflexes were absent 5 times. There was one case of impotence; one of an aggravated

psychosis. In general the symptoms and physical findings pointed to a combined sclerosis; no case of true posterior sclerosis was seen. Among the 26 cases there were 14 deaths in the hospital. Only 3 of the 26 cases showed erythrocyte counts of less than 1,000,000 on admission; the leukocytes averaged 6630; there were only 4 cases with a lymphocytosis; in these the highest total leukocyte count was 4000.

We may infer that the predominance of the nervous symptoms renders the prognosis worse independently of the grade of the anemia. In 15 cases the blood Wassermann was negative; in 11 both blood and spinal fluid Wassermanns were negative. In 1 case there was a positive blood Wassermann with a negative spinal fluid. The spinal fluid was negative, except for a slight increase of pressure once, in all the 12 cases. The process in the cord must be a selective toxic degenerative process, not inflammatory and probably not syphilitic. The symptoms and signs of cord involvement without a positive spinal fluid call for a careful examination of the blood.

Of the 22 cases which went to autopsy 5 proved not to be pernicious anemia. These included (1) a case of Laennec's cirrhosis in which the clinical diagnosis had evidently been based on the blood findings in spite of the ascites. The blood findings were in the main those usually regarded as characteristic of primary anemia, namely, hemoglobin 26, erythrocytes 1,165,000, color-index 1.3. There were also nucleated reds of all sizes. The leukocyte count was 11,200 and the differential normal. (2) Aortic stenosis and regurgitation, with a question about pernicious anemia because of the blood findings. These were hemoglobin 26, erythrocytes 1,340,000, color-index 1, leukocytes 3750. Differential count showed a slight polymorphonuclear relative increase. The autopsy showed the aortic lesions and a moderate interstitial nephritis. The characteristic findings of pernicious anemia were not present. (3) A case of streptococcic septicemia. A poor history had been obtained from this patient. The hemoglobin was 42, erythrocytes 1,916,000, color-index 1+, leukocytes 2850; nucleated reds were not recorded. The autopsy showed an acute serofibrinous pericarditis, embolic abscesses of the bowel and a "large septic spleen." (4) This patient gave a history of sudden onset two weeks previous to admission; there was fever, with chills, sweats, weakness, dizziness and nervousness. The ophthalmoscope showed small flame-shaped hemorrhages; there were inconstant rales in the left axilla about the sixth interspace. Gastric analysis showed no free HCl; total acidity 15. The feces were negative for pus, ova, parasites or blood. Blood examination showed hemoglobin 21, erythrocytes 1,208,000, color-index 1, leukocytes 4450, small lymphocytes 57, large lymphocytes 23, polymorphonuclears 13, basophils 1, myelocytes 6 and many nucleated reds. This case is particularly interesting because it simulates so closely the findings of an aplastic anemia. The onset described in

the history is somewhat inconsistent with pernicious anemia, but it is often difficult to get an accurate history from patients at the County Hospital. Aside from this the features which made the case one not to be regarded as typical of an essential anemia were the color-index just about normal and the predominance of lymphocytes, even though blood formation was still active, as shown by the presence of myelocytes and nucleated reds. Yet the blood findings in the absence of definite findings of another disease, the retinal hemorrhages, and the achylia made the diagnosis of pernicious anemia a logical one, and the result emphasizes what is perhaps the thing most to be remembered about pernicious anemia: the disease can be exactly simulated by the anemia dependent on some definite etiologic factor, such as carcinoma or tuberculosis. In this case the autopsy showed; "Nodular fibrocaseous tuberculosis of the tracheal, bronchial, biliary, retroperitoneal and mesenteric lymph nodes; bilateral fibrocaseous and nodular pulmonary tuberculosis; nodular tuberculosis of the kidneys, liver and spleen, multiple hemorrhages into the epicardium and lining of the stomach; moderate bilateral serosanguineous pleuritis." (5) This case presented the symptoms of weakness, fainting and edema of the feet, palpitation and loss of weight and pain in the back in the lumbar region of both sides. There were no gastric disturbances. The patient was fifty-two years old. There was dilatation of the heart. The liver was palpable. Reflexes and sensation were normal, although the "gait was uncertain." Spinal fluid was negative. Wassermann was negative on the blood and spinal fluid. Blood-pressure was 120 systolic and 70 diastolic. Urine was negative. Blood examination showed hemoglobin 35, erythrocytes 1,770,000, color-index 1.4, leukocytes 12,400. There is a note on the history: "The findings make quite certain the diagnosis of pernicious anemia." The feces were not examined. The autopsy disclosed an "annular carcinoma of the ascending colon." The pathologic conditions characteristic of pernicious anemia were not present. The pain in the back should not have been ignored and it may be emphasized that the leukocytosis should not have been disregarded.

Of the remaining 17 cases 9 went to autopsy as pernicious anemia alone. This diagnosis was confirmed in all without essential modification. In one case an acute pericarditis was found, probably terminal. In another the patient had evidently died of an acute pulmonary edema. The protocol of G. F., who died at the age of twenty-two years, may be taken as representative of the group: "Systemic anemia; marked fatty changes in liver, myocardium and kidneys; fatty degeneration of the lining of the aorta; 'red' bone-marrow; anasarca; passive hyperemia and edema of the lungs; moderate hyperplasia of the spleen; atrophic gastritis; left-sided fibrous pleuritis; disseminated petechial hemorrhages in the gastric mucosa and the mucous membrane of the urinary bladder." Two

cases were diagnosed pernicious anemia and lobar pneumonia; one pernicious anemia and chronic nephritis; one pernicious anemia and parotitis; all of these were essentially confirmed; 2 cases were both diagnosed pernicious anemia and organic heart disease. In both the diagnosis of pernicious anemia was correct; in 1 there was a chronic parenchymatous (large white) kidney but no heart disease other than the "marked fatty changes in the myocardium;" in the other the only cardiac changes noted were "dilatation of the mitral ring" and "fatty changes in the myocardium."

In 10 of the 15 cases the red count was below 1,000,000 on admission; two of the counts were below 500,000; the highest count was 2,000,000. The color-index was over 1 in all of the 15. The highest leukocyte count was 10,000 and the lowest 1300; the average was 4530. Seven, or 58 per cent. of the cases in which a differential leukocyte count was made showed a relative lymphocytosis. In one case the total count was 4900, with a lymphocyte count of 88 per cent. In 12 of the 15 cases nucleated reds were found. Our views of the blood findings, commonly accepted as characteristic of pernicious anemia, were confirmed by these autopsies; the cases which went to autopsy, in which the pathology of pernicious anemia was found, had conformed clinically most closely to the accepted standards of pernicious anemia. Of the 15 patients 12 were men; 2 were under thirty years of age (one was only twenty-two), 6 between thirty and forty, 5 between fifty and sixty and 2 over sixty. All were white.

An apical systolic murmur was found in 3 cases, basal systolic in 4 and a murmur systolic in time, both at base and apex, in 2. In 1 case there were described a presystolic thrill and murmur at the apex; no valvular disease was found at autopsy. In another case the history contained a record of a presystolic thrill at the apex, a presystolic murmur at the apex and systolic and diastolic murmurs at the base. Duroziez's phenomenon was also present. *The autopsy protocol stated that the cardiac valves were normal.* The maximum systolic blood-pressure was 138 and the minimum 90; of 11 readings the systolic pressure was below 115 in 8; the average pulse-pressure was 50. The spleen was palpable in 5 cases. The urinary findings also corresponded to those obtained in the cases observed only clinically; the specific gravity was low in 10 cases; otherwise the findings in these were negative; in 1 there was a trace of albumin; in 1, without albumin, a few finely granular casts; in 2 without albumin, a few hyaline casts. Only 1, the case diagnosed as pernicious anemia and nephritis, showed albumin and hyaline and granular casts. The patient, in whom the chronic parenchymatous nephritis was later found, had shown nothing in her urine except some finely granular casts. The blood-pressure in this case was not taken. In the autopsy reports atrophy of the gastric mucosa was mentioned only 3 times. The spleen was hyperplastic in 10 cases.

the history is somewhat inconsistent with pernicious anemia, but it is often difficult to get an accurate history from patients at the County Hospital. Aside from this the features which made the case one not to be regarded as typical of an essential anemia were the color-index just about normal and the predominance of lymphocytes, even though blood formation was still active, as shown by the presence of myelocytes and nucleated reds. Yet the blood findings in the absence of definite findings of another disease, the retinal hemorrhages, and the achylia made the diagnosis of pernicious anemia a logical one, and the result emphasizes what is perhaps the thing most to be remembered about pernicious anemia: the disease can be exactly simulated by the anemia dependent on some definite etiologic factor, such as carcinoma or tuberculosis. In this case the autopsy showed; "Nodular fibrocaseous tuberculosis of the tracheal, bronchial, biliary, retroperitoneal and mesenteric lymph nodes; bilateral fibrocaseous and nodular pulmonary tuberculosis; nodular tuberculosis of the kidneys, liver and spleen, multiple hemorrhages into the epicardium and lining of the stomach; moderate bilateral serosanguineous pleuritis." (5) This case presented the symptoms of weakness, fainting and edema of the feet, palpitation and loss of weight and pain in the back in the lumbar region of both sides. There were no gastric disturbances. The patient was fifty-two years old. There was dilatation of the heart. The liver was palpable. Reflexes and sensation were normal, although the "gait was uncertain." Spinal fluid was negative. Wassermann was negative on the blood and spinal fluid. Blood-pressure was 120 systolic and 70 diastolic. Urine was negative. Blood examination showed hemoglobin 35, erythrocytes 1,770,000, color-index 1.4, leukocytes 12,400. There is a note on the history: "The findings make quite certain the diagnosis of pernicious anemia." The feces were not examined. The autopsy disclosed an "annular carcinoma of the ascending colon." The pathologic conditions characteristic of pernicious anemia were not present. The pain in the back should not have been ignored and it may be emphasized that the leukocytosis should not have been disregarded.

Of the remaining 17 cases 9 went to autopsy as pernicious anemia alone. This diagnosis was confirmed in all without essential modification. In one case an acute pericarditis was found, probably terminal. In another the patient had evidently died of an acute pulmonary edema. The protocol of G. F., who died at the age of twenty-two years, may be taken as representative of the group: "Systemic anemia; marked fatty changes in liver, myocardium and kidneys; fatty degeneration of the lining of the aorta; 'red' bone-marrow; anasarca; passive hyperemia and edema of the lungs; moderate hyperplasia of the spleen; atrophic gastritis; left-sided fibrous pleuritis; disseminated petechial hemorrhages in the gastric mucosa and the mucous membrane of the urinary bladder." Two

cases were diagnosed pernicious anemia and lobar pneumonia; one pernicious anemia and chronic nephritis; one pernicious anemia and parotitis; all of these were essentially confirmed; 2 cases were both diagnosed pernicious anemia and organic heart disease. In both the diagnosis of pernicious anemia was correct; in 1 there was a chronic parenchymatous (large white) kidney but no heart disease other than the "marked fatty changes in the myocardium;" in the other the only cardiac changes noted were "dilatation of the mitral ring" and "fatty changes in the myocardium."

In 10 of the 15 cases the red count was below 1,000,000 on admission; two of the counts were below 500,000; the highest count was 2,000,000. The color-index was over 1 in all of the 15. The highest leukocyte count was 10,000 and the lowest 1300; the average was 4530. Seven, or 58 per cent. of the cases in which a differential leukocyte count was made showed a relative lymphocytosis. In one case the total count was 4900, with a lymphocyte count of 88 per cent. In 12 of the 15 cases nucleated reds were found. Our views of the blood findings, commonly accepted as characteristic of pernicious anemia, were confirmed by these autopsies; the cases which went to autopsy, in which the pathology of pernicious anemia was found, had conformed clinically most closely to the accepted standards of pernicious anemia. Of the 15 patients 12 were men; 2 were under thirty years of age (one was only twenty-two), 6 between thirty and forty, 5 between fifty and sixty and 2 over sixty. All were white.

An apical systolic murmur was found in 3 cases, basal systolic in 4 and a murmur systolic in time, both at base and apex, in 2. In 1 case there were described a presystolic thrill and murmur at the apex; no valvular disease was found at autopsy. In another case the history contained a record of a presystolic thrill at the apex, a presystolic murmur at the apex and systolic and diastolic murmurs at the base. Duroziez's phenomenon was also present. *The autopsy protocol stated that the cardiac valves were normal.* The maximum systolic blood-pressure was 138 and the minimum 90; of 11 readings the systolic pressure was below 115 in 8; the average pulse-pressure was 50. The spleen was palpable in 5 cases. The urinary findings also corresponded to those obtained in the cases observed only clinically; the specific gravity was low in 10 cases; otherwise the findings in these were negative; in 1 there was a trace of albumin; in 1, without albumin, a few finely granular casts; in 2 without albumin, a few hyaline casts. Only 1, the case diagnosed as pernicious anemia and nephritis, showed albumin and hyaline and granular casts. The patient, in whom the chronic parenchymatous nephritis was later found, had shown nothing in her urine except some finely granular casts. The blood-pressure in this case was not taken. In the autopsy reports atrophy of the gastric mucosa was mentioned only 3 times. The spleen was hyperplastic in 10 cases.

Two cases went to autopsy with a diagnosis of "suspected abdominal malignancy;" in 1 case the color-index was high; the highest leukocyte count was 6800; there were no nucleated erythrocytes; in the other case no blood counts were recorded, as the case apparently was regarded as certainly one of malignancy. In both cases the characteristic findings of pernicious anemia were present.

Fifteen cases in another group were discharged as pernicious anemia but with some qualification. Of these 10 were males; the youngest patient was ten; 4 others were under thirty; 5 between thirty and forty and 5 over forty. There is a notable variation here from the age incidence in the cases of true pernicious anemia. In the latter the proportion of patients over 40 was distinctly greater. Six of the 15 patients died in the hospital.

This group can best be considered in several subgroups:

Two cases of pernicious anemia with nephritis. In one case the urine contained much albumin, hyaline and granular casts and red blood cells; in the other there was generalized edema, with dyspnea, headache and insomnia; the color was waxy; there was evidence of fluid in both pleural cavities; the urine was albuminous, containing hyaline and granular casts. The respective blood counts were hemoglobin 36, erythrocytes 1,690,000, color-index 1.4, leukocytes 6400, differential count normal; no nucleated reds. Hemoglobin 15, erythrocytes 1,560,000, color-index, 0.4, leukocytes 26,200. Obviously the latter may be dismissed as nephritis, with severe secondary anemia.

Three cases with hemorrhages: The first, a man aged thirty-seven years, had epistaxis and hemorrhages from the bowels; the gums bled easily; there were also hemorrhages from the ear. The blood count showed hemoglobin 22, erythrocytes 1,165,000, color-index about 1, leukocytes 12,000, with 86 per cent. polymorphonuclears. The history is that of a purpura hemorrhagica; the findings are those of a secondary anemia.

The second, a man, aged forty-five years, who complained of loss of blood during defecation, persisting for some time and growing worse, until at the time of entrance to the hospital he was passing an ounce or two with every movement of the bowels. No hemorrhoids were found. The blood count was hemoglobin 37, erythrocytes 1,808,000, color-index 1.1, leukocytes 3600, with a relative lymphocytosis, small lymphocytes 38 per cent. and large 15 per cent. There was poikilocytosis but no nucleated reds were found.

The third, a man, aged thirty-six years, with hemoptysis and severe nose-bleed. The day before his death it was noted that he had a "profuse hemorrhage from mouth and nose." The blood count shortly before his death was hemoglobin 25, erythrocytes 960,000, color-index 1.3, leukocytes 21,300; polymorphonuclears 84 per cent.; a few nucleated reds. Again the findings are not typical of pernicious anemia.

Four cases of pernicious anemia with heart disease. The first showed general anasarca and dyspnea, with marked evidence of ascites; there was a systolic blow at the apex, with a gallop rhythm. The blood count was hemoglobin 10, erythrocytes 742,000, color-index 0.7, leukocytes 4800, polymorphonuclears 75, myeloblast 1.

The second patient had mitral insufficiency with healed apical tuberculosis. The blood-count on admission was hemoglobin 18, erythrocytes 896,000, color-index 1.2, leukocytes 2550; there was a relative lymphocytosis, these cells making 50 per cent. After transfusions the patient improved very much, leaving the hospital ten weeks after admission with a red count of 2,608,000 and a hemoglobin of 45. The dilated heart, the mitral murmur and the evidence of old tuberculosis fail to convince one that this was not a case of pernicious anemia, with cardiac findings, such as have been discussed. There was, moreover, no record of generalized edema nor of cardiac dyspnea.

The third was a case diagnosed as pernicious anemia, with mitral stenosis, regurgitation and aortitis. There was a history of rheumatism and symptoms of cardiac incompetency for eighteen months. There were moist rales over the bases of the lungs. Blood count was hemoglobin 17, erythrocytes 1,244,000, color-index 0.8, leukocytes 6800, polymorphonuclears 77 per cent.; no nucleated reds.

The fourth case was characterized by generalized anasarca, dyspnea and a tendency to nose-bleed; the heart was very irregular. The blood count was hemoglobin 23, erythrocytes 719,000, leukocytes 8000, color-index, 1.6, differential normal; very few nucleated reds. The urine was negative. The feces contained no blood, but did show a great many of the parasites known as trichomonas intestinalis, an organism usually regarded as non-pathogenic.

Two cases with a definite focus of infection. The first is one of the most interesting cases of the series. The patient, a man, aged fifty-four years, entered the hospital May 6, 1918. He presented the usual symptoms of pernicious anemia, but in addition complained of a pain in the left leg, deep in the bone, which had been present for six years. The blood count on admission showed hemoglobin 45, erythrocytes 1,190,000, color-index 1.9, leukocytes 3200, poikilocytosis and small lymphocytes 78 per cent., large lymphocytes 6 per cent., polymorphonuclears 14 per cent., eosinophils 2 per cent., 1 normoblast was found. Four weeks later his erythrocytes were 770,000. He was transfused June 30, 600 c.c. of blood being given. On July 15, his blood count was hemoglobin 29, erythrocytes 1,370,000, color-index 1.08, leukocytes 6650. One week later an incision was made over the upper one-third of the left tibia through the periosteum and 4 ounces of pus were discharged. Eight days after the operation the hemoglobin was 45, erythrocytes 2,220,000, color-index 1.03, leukocytes 7750. Two weeks after the transfusion his hemoglobin had increased from 18 to 29, his erythrocytes from

770,000 to 1,370,000; eight days after the successful drainage of a subperiosteal abscess the hemoglobin had increased from 29 to 45 and the erythrocytes from 1,370,000 to 2,220,000. He was discharged September 9 with a hemoglobin of 63, erythrocytes 3,280,000 a color-index of 1 and a leukocyte count of 6300.

The second was the case of a boy, aged seventeen years, who had been operated on for an osteomyelitis of the left femur ten months previously. For a while he ran a temperature of 104°. Chronic osteomyelitis was found on Roentgen-ray examination but no local symptoms appeared and no operation was done. No other focus of infection was found. His blood count was hemoglobin 27, erythrocytes 725,000, color-index 1.92, leukocytes 2900, small lymphocytes 44 per cent., large lymphocytes 10 per cent., polymorphonuclears 44 per cent., eosinophils 1 per cent., transitionals 2 per cent. This patient died after a transfusion.

The question of diagnosis in this instance must be regarded as unsettled.

Of the 4 cases remaining one was probably a case of sprue and so noted. He had been a patient in a U. S. Army hospital in the Philippines. For two years he had suffered with stomatitis and diarrhea. The stools were frothy, whitish, very foul and contained no blood. The blood count, at the lowest, showed hemoglobin 20, erythrocytes 990,000, leukocytes 4000; no nucleated reds and a normal differential white count.

The second was the case of a man in whom the Roentgen ray discovered a lesion at the pylorus. The blood examination showed the findings usual in secondary anemia except for a high color index and a white count of only 5400, once as low as 2800.

The third case was one of "old pulmonary fibrosis, with an advanced secondary anemia" (a red corpuscle count of 1,480,000) and a high color-index.

The fourth was a case originally diagnosed as Banti's disease and discharged from the hospital October 26, 1915, with that diagnosis. She returned in December of the same year and died two months later of pneumonia. She entered the hospital the first time, with a marked ascites. A large spleen was palpated and the patient stated that she had known of this enlargement for twenty years. She was tapped three times. The specific gravity of the fluid was 1006 to 1010. Her lowest blood count was hemoglobin 25, erythrocytes 3,000,000, color-index, 0.5, leukocytes 3400. At the time of the second admission the blood examination showed hemoglobin 5, erythrocytes 870,000, leukocytes 34,000, polymorphonuclears 87 per cent.; all forms of nucleated reds. The most plausible theory about this case is that some of the findings of pernicious anemia (particularly the presence of nucleated erythrocytes) had developed on the basis of a long-standing secondary anemia. The original diagnosis of Banti's disease was probably correct.

In summarizing the last group of cases we find that in only 2 cases was the spleen palpable. One of these cases was the one originally diagnosed as Banti's disease; in 10 cases it was expressly stated that the spleen was not palpable. In 9 cases the color-index was above 1. There was a leukocytosis of more than 10,000 in 3 cases. In no case were the nucleated forms of the red corpuscles easily found. In 8 cases none were found and in the others they were very rare. In only 3 of the cases, or 20 per cent., did the lymphocytes exceed the polymorphonuclears. In the cases demonstrated at autopsy as pernicious anemia 43.7 per cent. showed relative lymphocytosis. In 2 of these 3 cases there were no nucleated reds; the third was the case of suppurative periostitis already described, which showed a high index, a relative lymphocytosis and very few normoblasts. As a general conclusion we may say that these findings warrant the opinion that great reserve should be exercised about making a diagnosis of pernicious anemia when all the characteristic blood findings are not present. In this type of case search for a definite etiologic factor is most urgent.

It would be a thankless task to attempt a review of the medicinal therapy, but we are interested in the use of human blood as a therapeutic procedure. There were in all records of 30 injections of human blood in 19 cases; 26 of these were intravenous transfusions with citrated blood in 16 patients; 3 were subcutaneous injections of whole blood, in 2 patients, and there was one subcutaneous injection of defibrinated blood.

In the last case 200 c.c. of defibrinated blood were injected subcutaneously, without reaction or result. In two cases whole blood was used subcutaneously. In one 20 c.c. of whole blood were injected without reaction or result. In the second one injection of 30 c.c. was given, with a slight reaction and no therapeutic effect. Four days later a second injection of 60 c.c. was given. Three hours after the injection the patient had a chill lasting twenty minutes: the condition improved but the pulse remained rapid and weak. Four days after the injection the temperature went to 102.6°. The next day evidence of suppuration was discovered in the buttock into which the injection had been made. Four days later the patient died. Death is attributable to the injection of blood only indirectly; it was not the result of a reaction but of an infection which the already debilitated patient could not stand.

Twenty-six intravenous injections of blood with sodium citrate were given to 16 patients; 2 of these were of small amounts, 10 c.c. to each of two patients. There was no reaction in either case and no benefit was apparent. The other transfusions varied in amount from 200 to 600 c.c. Three of these were done at Wesley Hospital on a patient afterward admitted to the County. In 4 of these no improvement is noted on the chart; after 17 of the transfusions distinct improvement was noted. We may cite 3 cases: the first,

with a hemoglobin of 16 and a red count of 888,000, was transfused the first time September 24, 1916; three days later the blood examination showed hemoglobin 16, erythrocytes 1,536,000. The count fell to 808,000 on October 2; on October 3, another transfusion was done; on October 4, the count was 1,840,000; each transfusion was followed by an increased leukocyte count; following the second transfusion improvement was steady and the patient, much better, was discharged November 21.

In the second case the red count, August 5, 1918, was 1,050,000, with a hemoglobin of 30 and a leukocyte count of 2050. Transfusion was done on the seventh, and nine days later the blood examination showed hemoglobin 50, erythrocytes 4,070,000, leukocytes 4100. The patient, in good condition, left the hospital September 9.

A third case after the first transfusion showed a rise in the erythrocytes from 990,000 to 1,300,000; after the second, the hemoglobin rose from 25 to 35, the erythrocytes from 990,000 to 1,300,000; after the third the hemoglobin was unchanged at 30; the erythrocytes rose from 1,700,000 to 2,350,000. This patient did not continue to do well. A splenectomy was advised but refused; the patient shortly afterward was taken home in poor condition against our advice. There were 11 patients in this group showing improvement after transfusion; prior to the first transfusion the highest erythrocyte count was 1,200,000; only 3 patients had more than 1,000,000 erythrocytes; 8 of the 11 left the hospital improved (one improved after the transfusion, but much more rapidly after a collection of pus was evacuated, as mentioned elsewhere), 1 left the hospital in poor condition and 2 died in the hospital; one of these latter, shortly before her death, had an erythrocyte count of 3,800,000 and a hemoglobin percentage of 75; it had not been deemed necessary to transfuse her for four months; she died of complications incident to combined cord degeneration. We may say that of the 11 cases 9 showed marked improvement in the blood condition.

Three deaths occurred shortly after transfusion; in one case the transfusion was carried out as a measure of last resort in a moribund patient; there was no typical reaction and the death cannot be charged to the transfusion. In 1 case while the transfusion was in progress the patient complained of "dizziness and faintness, then became dyspneic, was nauseated and tried to vomit; there was headache and a clammy perspiration broke out; the transfusion was stopped. One-half hour later a severe chill occurred, lasting fifteen minutes; two hours later an attack of severe abdominal pain, dyspnea, pulse imperceptible; death occurred one-half hour later." The other fatal reaction took practically the same course. There were in all six severe reactions and three mild ones; seven of the transfusions were followed by no reaction.

There is a record of one splenectomy in the series; the operation was done after the patient had been in the hospital for three months

and had made a notable gain; the patient was discharged in good condition one month after operation.

In reviewing the results of this study, we find:

1. The clinical complex known as pernicious anemia presents certain characteristic blood findings, particularly the high color-index, the presence of many large erythrocytes and of nucleated red cells, especially megaloblasts, and a tendency to a leukopenia, with a relative lymphocytosis; the clinical symptoms, though secondary in importance from the standpoint of diagnosis, are yet distinct and definite. The progressive weakness, the gastric disturbances; the dyspnea, pallor, the cardiac findings and the edema of the feet are the most typical and constant findings.

2. Though pernicious anemia has its own characteristic diagnostic findings these may be simulated closely by anemias resulting from various diseases; in fact, the blood picture of pernicious anemia may be presented exactly as the result of some definite septic, toxic or malignant condition. The diagnosis should rest not on the blood findings alone nor on the blood findings and symptomatology, but on these two features in the absence of any discoverable cause for the anemia.

3. The disease is more common in males and is most frequent in the fourth and fifth decades of life.

4. The cardiac symptoms and physical findings (the murmurs and the dilatation of the heart) are so constant as to be looked upon as among the most common symptoms of the disease. Anatomically valvular disease is not a part of pernicious anemia; the cardiac findings are the result of myocardial weakness and relative insufficiency. Ascites and anasarca are not symptoms of pernicious anemia though there is a possibility that they may result from cardiac incompetency, this event is so unusual that their presence demands explanation.

5. The systolic blood-pressure is almost never above normal but tends to be below the lower limit of normal; the diastolic pressure is disproportionately low and the pulse-pressure high.

6. The urine is usually of a fairly low specific gravity, rather increased in quantity, and rarely contains albumin. The presence of albumin is not to be accepted as a usual finding in pernicious anemia; its presence with casts means nephritis, which may be the cause of the anemia rather than the effect.

7. Pernicious anemia is characterized by an irregular temperature, which is not often above 101°; there are often recessions to normal of variable duration.

8. Achylia gastrica is so much the rule that the presence of free HCl may justifiably raise a doubt as to the diagnosis.

9. The Wassermann reaction occurs infrequently in pernicious anemia. In 46 cases there was a percentage incidence of 6.5; the general run of cases in a large charity hospital would probably

show a higher percentage. It is possible that certain changes in the blood incident to the disease interfere with the reaction.

10. The gradual decrease in the leukocyte count, especially in the relative and absolute number of polymorphonuclears, is of serious prognostic import. The diagnosis of pernicious anemia should be made with the utmost reserve in the presence of a leukocytosis.

11. The negative spinal fluid tests in the presence of well-established cord disease point to a toxic degenerative process in the cord rather than an inflammatory process. Disease of the cord, with pernicious anemia, usually means an involvement of the lateral and posterior columns, a combined cord lesion. The presence of evidences of cord disease is of unfavorable prognostic import; the prognosis in these cases is grave, out of proportion to the blood findings as compared to the cases not so complicated. These patients are less likely to live long enough to develop advanced grades of anemia.

12. Transfusion of blood will not cure but will often prolong the patient's life. The severe reactions which occurred in this series were likely the result of imperfect technic; the procedure has really been developed from its inception in the years covered by this study; transfusions are now being done with a much lower percentage of reaction. Yet the experiences noted here may have a valuable lesson for us. The transfusion of citrated blood is a simple procedure but not a harmless one. Before the operation is undertaken the bloods of donor and patient must be demonstrated to be compatible by an acceptable and approved technic.

REVIEWS

A Manual of Physical Diagnosis. By Austin Flint, M.D., LL.D. Eighth edition, revised by Henry C. Thacher, M.S., M.D., Assistant Professor of Clinical Medicine in the College of Physicians and Surgeons of Columbia University, etc. Pp. 362; 26 illustrations. Philadelphia and New York: Lea & Febiger, 1920.

As the pendulum swings back toward the greater importance of the simpler methods of clinical study, we may expect more and more attention to be focussed on the fundamental physical examination of the patient. Perhaps no one in this country has contributed more to the underlying principles involved in this branch of clinical medicine than Austin Flint. It is therefore a pleasure to have his simple and pointed presentation of the subject kept thoroughly up to date, brought to our attention from time to time as the new editions arrive. The present revision by Dr. Thacher includes some new material, especially upon effort syndrome, the unusual signs that may sometimes be heard over the normal heart and the diagnosis of pulmonary tuberculosis on uncertain and insufficient evidence; yet the *Manual* retains the simple and logical presentation of the original author. Although the first third of the book is given over to a discussion of percussion and auscultation in health and disease the other methods of examination, particularly inspection and palpation, are not neglected when the actual physical diagnosis of disease is under consideration. In each instance the physical conditions met with in health are presented before those alterations met with in disease. Although too brief to cover the subject in great detail and to enter into controversial matters, this *Manual* will continue to rank as one of the standard works on physical diagnosis.

T. G. M.

Wheeler's Handbook of Medicine. By William R. Jack, B.Sc., M.D., F.R.F.P.S.G. Physician to the Glasgow Royal Infirmary; Lecturer in Clinical Medicine in the University, Glasgow. Sixth edition. Pp. 561; 28 illustrations. Edinburgh: E. & S. Livingston; New York: William Wood & Co., 1920.

This small handbook, which, though containing more than 500 pages, is small in length and width, apparently presents the impor-

tant facts of internal medicine in a brief and precise manner. The book is a good example of the small manuals of medicine, but has the usual faults characteristic of such medical abstracts. The only obvious advantage of these abridged editions seems to be in the marshalling of the salient facts of medicine so that one reviewing for examinations may cover the entire subject in a short time. J. H. M., Jr.

The Medical Clinics of North America. Volume III, Number 6. Pp. 1493–1779. Philadelphia and London: W. B. Saunders Company, 1920.

The Chicago number of the *Clinics of North America* contains a large number of case reports and articles on various types of diseases considered for the most part from a diagnostic and therapeutic standpoint. Dr. Mix contributes an article on encephalitis and also one on mediastinal tumors. Dr. Abt writes on infantile eczema as well as presenting a symposium clinic. Dr. Williamson discusses lymphosarcoma of the neck and pernicious anemia, with extreme dropsy, while Dr. Strouse deals with urticaria and angioneurotic edema. Dr. Carr reports 2 cases—1 of bronchiectasis with pulmonary hemorrhage and 1 of gall-stones with chronic jaundice. Colic in the breast-fed infant is the subject selected by Dr. Grulee, while Dr. Bassoe describes some cases of brain abscess. Dr. Sonnenschein introduces the subject of headache from the point of view of the otolaryngologist. Cerebrospinal syphilis and encephalitis are gone into carefully by Dr. Hamill, while Dr. Hamburger demonstrates the protean character of angina pectoris. Dr. Friedman writes on gastric ulcer and chronic enterocolitis. The remaining three articles are by Dr. Hess, Dr. Wright and Dr. Portis. A particularly suggestive contribution is that of Dr. Byfield, who analyzes some of the more important causes of error in diagnosis and shows us the mistakes that we make are frequently due to carelessness, lack of complete examination and improper history-taking, errors which we can successfully overcome by proper care and study of the patient. J. H. M., Jr.

Simplified Infant-feeding. By Roger H. Dennett, M.D., Associate Professor of Diseases of Children, New York Post-Graduate Medical School, etc. Second edition. Pp. 385; 14 illustrations. Philadelphia and London: J. B. Lippincott Co., 1920.

This book is a departure from the usual in infant-feeding. There is no review of the literature. The author describes a method of

feeding based upon the calorific requirements of the infant. It is hardly necessary to enumerate the various chapters, but the principles followed may be shown by quoting this much: "In prescribing food for any infant there are three main points for consideration: (1) It should contain the proper elements to maintain nutrition and allow growth; (2) it should be digestible; and (3) it should contain the proper quantity of food, which is best estimated by caloric standards."

Certainly one must have some rule or system by which to judge the requirements of a normal infant—always realizing that the infant is an individual and may be subject to variation. From the basis of the normal requirement, the food of the sick infant is to be manipulated as indicated. By following Dr. Dennett's method one can be quite successful in infant-feeding. However, the reviewer feels that it is not a complete method and one should also be cognizant of the percentages of the various ingredients, and their actual amount, present in the mixture. It is the custom of many to use the calories of a food as the check upon the method, rather than as the actual basis upon which to calculate requirements.

A. G. M.

THE CATARRHAL AND SUPPURATIVE DISEASES OF THE ACCESSORY SINUSES OF THE NOSE. By ROSS HALL SKILLERN, M.D., Professor of Laryngology, Graduate School of Medicine, University of Pennsylvania, etc. Third edition, thoroughly revised and enlarged. Pp. 418; 300 illustrations. Philadelphia: J. B. Lippincott Company, 1920.

SPACE does not permit, nor is it necessary to attempt, an extended review of Skillern's well-known *Accessory Sinuses*, now in its third edition. The early exhaustion of the two previous editions demonstrates the necessity for and popularity of the work, and it is the recognized authority on the special subjects to which it is devoted. The new edition contains all the material and information of the former editions, and in much the same form, additions having been made when called for, due to progress in this special field, and bringing the subject-matter up to date by many references to the literature of the last four years. The author has, moreover, incorporated into the text the observations of himself and others on infections and injuries of the sinuses during the recent war, in so far as they apply to civilian practice.

Particular attention has been given to the question of sinusitis in infants and children, on which much work has been done in the last few years by Skillern, Dean and Armstrong, Coffin, Oppenheimer and others. This is an important subdivision of the subject, much neglected by the profession until comparatively recently, and one

tant facts of internal medicine in a brief and precise manner. The book is a good example of the small manuals of medicine, but has the usual faults characteristic of such medical abstracts. The only obvious advantage of these abridged editions seems to be in the marshalling of the salient facts of medicine so that one reviewing for examinations may cover the entire subject in a short time. J. H. M., Jr.

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This book is a departure from the usual in infant-feeding. There is no review of the literature. The author describes a method of

feeding based upon the calorific requirements of the infant. It is hardly necessary to enumerate the various chapters, but the principles followed may be shown by quoting this much: "In prescribing food for any infant there are three main points for consideration: (1) It should contain the proper elements to maintain nutrition and allow growth; (2) it should be digestible; and (3) it should contain the proper quantity of food, which is best estimated by caloric standards."

Certainly one must have some rule or system by which to judge the requirements of a normal infant—always realizing that the infant is an individual and may be subject to variation. From the basis of the normal requirement, the food of the sick infant is to be manipulated as indicated. By following Dr. Dennett's method one can be quite successful in infant-feeding. However, the reviewer feels that it is not a complete method and one should also be cognizant of the percentages of the various ingredients, and their actual amount, present in the mixture. It is the custom of many to use the calories of a food as the check upon the method, rather than as the actual basis upon which to calculate requirements.

A. G. M.

THE CATARRHAL AND SUPPURATIVE DISEASES OF THE ACCESSORY SINUSES OF THE NOSE. By ROSS HALL SKILLERN, M.D., Professor of Laryngology, Graduate School of Medicine, University of Pennsylvania, etc. Third edition, thoroughly revised and enlarged. Pp. 418; 300 illustrations. Philadelphia: J. B. Lippincott Company, 1920.

SPACE does not permit, nor is it necessary to attempt, an extended review of Skillern's well-known *Accessory Sinuses*, now in its third edition. The early exhaustion of the two previous editions demonstrates the necessity for and popularity of the work, and it is the recognized authority on the special subjects to which it is devoted. The new edition contains all the material and information of the former editions, and in much the same form, additions having been made when called for, due to progress in this special field, and bringing the subject-matter up to date by many references to the literature of the last four years. The author has, moreover, incorporated into the text the observations of himself and others on infections and injuries of the sinuses during the recent war, in so far as they apply to civilian practice.

Particular attention has been given to the question of sinusitis in infants and children, on which much work has been done in the last few years by Skillern, Dean and Armstrong, Coffin, Oppenheimer and others. This is an important subdivision of the subject, much neglected by the profession until comparatively recently, and one

that is of peculiar interest not only to every rhinologist but to the pediatrist and general practitioner as well. As the subject is still in the developmental and theoretical stage, undue space is not given to it, the accepted facts, as far as demonstrated, being alone presented.

"When to operate in maxillary sinusitis" is an entirely new contribution, introduced with the idea of clearing up, in a systematic way, many of the difficulties encountered by beginners in the specialty. The subject is thoroughly discussed from all angles and plain rules for guidance given.

New methods discussed and described in detail are Lothrop's operation on the frontal sinus and Sluder's upon the ethmoid labyrinth. The chapter upon the sphenoid sinus has been entirely and thoroughly revised. Many new illustrations have been added describing these and other procedures, so that the volume remains, as it has always been, one of the best and most clearly illustrated text-books in medicine. In view of the fact that since their return from military service many recruits have been and are being made to the specialty of rhinology, this work should continue the popularity of the previous editions, and be an acceptable text-book in the numerous institutions now giving postgraduate instruction in this subject. G. M. C.

THE DON QUIXOTE OF PSYCHIATRY. By VICTOR ROBINSON. Pp. 334. New York: Historico Medical Press.

THIS book gives a friendly account of the life of Dr. S. V. Clevenger, a distinguished psychiatrist, who was one of the early leaders in the institution treatment of the insane in this country. It is a very interesting book, for it not only discusses Dr. Clevenger, but gives interesting side-lights of other figures in medicine of men who were contemporaries of Clevenger, such as Leidy, Pepper and Hammond. It is a worthy tribute to a man who has meant a great deal in psychiatry.

MANUAL OF PRACTICAL ANATOMY (CUNNINGHAM). Revised and edited by ARTHUR ROBINSON, Professor of Anatomy in the University of Edinburgh. Seventh edition. Volume II. Pp. 524; 23 illustrations. New York: William Wood & Company, 1920.

IN this edition the general text has been revised and many new figures, representing dissections, sections and radiographs have been added. Instructions for dissection have been printed in a distinctive indented type, a feature of the book that will especially

appeal to the student. As a result of the additions to the work it has been thought advisable to publish the book in three volumes. Thus the second volume considers the thorax and abdomen.

The text matter is nicely arranged and the writer's style makes it very easy reading.

The new nomenclature is used throughout but in all instances the older terminology follows in brackets.

The manual is of a convenient size, printed with a clean clear-cut type and on a nice grade paper.

It makes a most excellent and convenient reference work.

E. L. E.

MANUAL OF PSYCHIATRY. By AARON J. ROSANOFF, M.D. Fifth edition. New York: John Wiley & Sons, Inc., 1920.

THIS fifth edition is an outgrowth of the English translation of the French *Manuel de Psychiatrie*, by J. Rogues de Fursac. In addition to the author the contributors are: H. L. Hollingsworth, associate professor of psychology, Columbia University, who contributed some chapters on psychology; Miss Mary C. Jarrett, who contributed the chapter dealing with applications of sociology in psychiatry; Clarence A. Neymann, M.D., who discusses lumbar puncture, cell count and chemical tests of cerebrospinal fluid. The book is divided into three parts: First, dealing with general psychiatry; second, special psychiatry; third, appendices, dealing with the technic of diagnostic procedures.

The first part, which deals with general psychiatry, is first rate, for here the author deals with a subject with which he is thoroughly familiar—that is psychiatry and its treatment. Perhaps those who are familiar with Freudian methods might consider the chapter on psycho-analysis as inadequate.

The second part, dealing with special psychiatry, is also well done, with the exception of that part which deals with psycho-neuroses. The author bases his views entirely upon his army experience, and particularly that obtained in Plattsburg. He comes to the conclusion that hysteria and malingering are one and the same thing. He further states that "it seems therefore justifiable to conclude that an illicit motive is an essential part of the mental mechanism of hysteria; but such motive need not be of a sexual nature, although it undoubtedly very often is." In discussing the hysteric personality, he states that the essential feature consists in a character defect which places the hysteric individual in close relation to the criminal.

The average neurologist will entirely disagree with the viewpoint quoted in the above paragraph, for it is held by one trained altogether in psychiatry, and furthermore based on the very limited experience

chiefly obtained, as admitted by the author, from a few months' experience among psychoneurotics in Plattsburg.

Part three deals with the technic of special diagnostic procedures, two of the chapters being written by Dr. Neymann. These deal with lumbar puncture and chemical tests, such as the Wassermann. They are not sufficiently technical for a laboratory worker but give the reader an idea as to what these processes consist of. The Stanford revision of the Binet-Simon intelligence scale takes up a whole chapter of seventy pages. A chapter consisting of seventy-four pages concerns itself with the Kent-Rosanoff free association test. These in their length are out of all proportion to the rest of the book, for dementia precox is given only thirty-two pages.

With these exceptions the book is a good one and the reader will find whatever advice he is looking for presented in a very sane, normal fashion.

SURGICAL CLINICS OF CHICAGO. August, 1920, Number. Vol. IV, No. 4. Pp. 214; 80 illustrations. Philadelphia: W. B. Saunders Company, 1920.

THE high standard of this work is still maintained in this number. It contains seventeen original articles by members of the contributing staff from the various Chicago hospitals. As the writers continue from number to number they more and more present their subjects as the general medical reader needs them presented. Yet they at the same time give minutiæ and detail that appeals to the special reader.

The work fills a need and fills it well. E. L. E.

THE NARCOTIC DRUG PROBLEM. By ERNEST S. BISHOP, M.D., Pp. 136. New York: The Macmillan Company, 1920.

THE author believes that drug-addicts suffer from a disease and that the victims should not be spoken of as "drug fiends" or the users as having the "drug habit." He thinks if addicts are carefully handled, first getting them in excellent physical condition and then withdrawing the opiates in a manner not harmful to the patients, that they can be cured of being addicts.

Dr. Bishop is of the opinion that the reason opiates are used is because of bodily need and not for the enjoyment that is received from their use. He further states that too many people think of these persons as being morally weak, unable and unwilling to discontinue the use of narcotics, whereas to do so causes physical

suffering. According to the author many of the legislators, administrators and even physicians do not fully understand the situation, and when the Harrison law was passed making it impossible for drug addicts to obtain narcotics, this either drives them into the "underworld," or, if unable to obtain opiates through illegal methods, to escape physical suffering they resort to suicide.

The book is written in a very clear manner; in fact, the author impresses upon the reader too often the same facts and few new thoughts are introduced after the first few pages. Besides the repetition the author strays from the point at issue, and in discussing any particular phase he invariably reverts to some part of the question previously discussed at length.

THE DIAGNOSIS OF NERVOUS DISEASES. By SIR JAMES PURVES STEWART, K.C.M.G., C.B.M.D. (Edin.), F.R.C.P. Fifth edition. Pp. 557. New York: E. B. Treat & Co., 1920.

THIS is the fifth edition of Stewart's well-known *Diagnosis of Nervous Diseases*. The fourth edition was written three years ago, while the author was on war duty in Saloniki. The present edition has been revised and in part rewritten. A short chapter on war neuroses regarded from their clinical standpoint has been added.

The scheme of the book is well worked out. It is not intended by any means to be an exhaustive text-book, but, as the title indicates, it is a diagnosis. The anatomy and physiology are adequately and well done. Aphasia is treated from the old and well-known standpoint and the recent controversial phases are omitted. Cerebellar conditions are adequately discussed, with the exception that no attention is paid to the more recent studies of localization. Peripheral nerve conditions are exceedingly well done, and so far as the reviewer knows this is the only book on neurology which has a chapter on organic war lesions. The fact that it has reached its fifth edition is ample evidence that the book is well worth while.

CAST GOLD AND PORCELAIN INLAYS. By HERMAN E. S. CHAYES, D.D.S., New York. Pp. 382; 372 illustrations. St. Louis: C. V. Mosby Company.

THIS is a scholarly addition to dental literature reflecting thoroughness and minute care on the part of the author in every detail.

The introduction comprising some fifty pages on sequence of

thought and the value in teaching is a most finished, thoughtfully written expression of fundamental facts well worth reading, although rather mature for the average student and not closely allied to the general subject.

The chapter on cavity preparation is comprehensive and practical. There is nothing radical or new, but it reflects the best thought on the subject, fully illustrated and giving a clear idea.

The author has gone most fully into the subject of cast gold fillings, the failures caused by faulty impressions, how to obviate them, and a very full and fair description of different casting methods and the results obtained.

The method for inlay work, their treatment and casting, splinting of teeth and the restoration of occlusial balance, and the treatment of the indirect method has the full allotment of space it deserves.

Porcelain work is well described in detail and comprehensively, which applies to the entire work.

Twenty pages are devoted to light and color, followed by a chapter on ductless glands as expressed in the human mouth, endocrinodontia. This is a field dentists must become more familiar with, and although there are few of us that can agree with Dr. Kaplan that the "frequency of decay in lower molars as compared with anterior teeth is due to the position of the submaxillary glands, etc.", the idea is very progressive. P. L. L.

PROGRESS
OF
MEDICAL SCIENCE

SURGERY

UNDER THE CHARGE OF

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ASSOCIATE PROFESSOR OF APPLIED ANATOMY AND ASSOCIATE IN SURGERY IN THE UNIVERSITY OF PENNSYLVANIA; SURGEON TO THE PHILADELPHIA GENERAL AND NORTHEASTERN HOSPITALS AND ASSISTANT SURGEON TO THE UNIVERSITY HOSPITAL.

Immediate Closure of Empyemata.—HATHAWAY (*British Med. Jour.*, May 29, 1920, p. 734) has always used a local anesthetic but is inclined to think that when handling the lung a little general anesthetic with it is useful. He resects sufficient rib, either a long section of one rib or adjacent parts of two ribs, to allow of the introduction of the whole hand into the pleural cavity. This is the most important point, because, after evacuation of the pus, it is essential to pass the hand into the chest cavity and strip off the collapsed lung all adherent fibrin and separate the lung from all adhesions. In any early case this is easily done, but an old standing one will require much freeing of the lung in order that it may recover its reëxpansibility. He then washes out the pleural cavity with flavine until the fluid comes away quite clean, and fills the chest with a 2 per cent. suspension of iodoform in sterilized paraffin. The pleural wound is then sewn up with catgut, not that he thinks this is very important, because these stitches soon give way. He then carried out immediate closure of the skin with deep sutures, so as to leave no "sucking" wound. When dressing on the next and following days the wound will be bulging. This is due to a mixture of pus and iodoform and paraffin being pushed out of the pleural cavity by the expanding lung under the skin. Daily he introduces the needle of an exploring syringe between the edges of the wound—this is quite painless—and extracts all the fluid he can. This process usually takes ten to fourteen days, depending upon the reëxpansion of the lung. Daily bacteriological report of this fluid shows that the number of organisms in a field steadily diminishes. A certain amount of this mixture of pus and iodoform and paraffin will ooze out also in the dressings. Harris has now sutured nine cases. His only failure was a tuberculous case. The patient died in twenty-four hours. Postmortem the lung was found tied in a knot at the root, he had evidently not explored the chest sufficiently with his hand. All of the other eight cases made good and rapid recoveries. The duration of the disease in these cases varied from two to six weeks, after the resolution of the primary pneumonia.

Volvulus of the Cecum; Double Obstruction.—SMITH (*British Med. Jour.*, February 28, 1920, p. 289) reports a case of volvulus of the cecum, the true nature of which was only discovered at autopsy. The patient, a male, aged thirty-three, had had attacks of indigestion for some years. They were not severe. He also had constipation, pain and discomfort after meals, with occasional vomiting. He had a sudden acute attack of abdominal pain, with vomiting. When seen by the author twenty hours later he had all the signs of symptoms of an acute abdominal catastrophe. The vomiting was not fecal. A right paramedian incision was made. The cecum and ascending colon were distended and turned toward the midline, forming a definite volvulus. The transverse colon was empty. It appeared that the hepatic flexure was the seat of the obstruction, so it was explored and an acute kink was found. A Paul tube was inserted into the cecum. Twenty-four hours later he developed symptoms of further obstruction, and in spite of treatment he died twenty-four hours later. Autopsy disclosed the following: From the point of obstruction at the hepatic flexure there stretched a thick, organized adhesion, passing across and adherent to the anterior leaf of the mesentery and fixed firmly to the ileum about two inches from the ileocecal valve. The small gut was acutely kinked here in a manner similar to that at the hepatic flexure. The original lesion was a tuberculous affection of the mesenteric glands. The author thinks the death due to the ileal obstruction and not to a paralytic distention.

The Uses of Free Transplants of the Fascia Lata in Surgery.—TURNER (*British Med. Jour.*, January 17, 1920, p. 79) says that it is to the late Murphy of Chicago, that we owe the more general use of free transplants of the fascia lata; he used these extensively in arthroplasty. Turner has used it in arthroplasties, in protecting deeper structures, such as sutured nerves or tendons, during the slow healing of wounds by granulation or when the superficial tissues are so much damaged that their recovery after suture is likely to be attended by sloughing. It is also exceedingly useful for the replacement of lost tendons. They are also useful in covering the exposed brain where the membranes are ruptured. Turner has used free fascial transplants in repairing the urethra. The transplants behave exceedingly well even when infection occurs. All transplants are removed through a vertical incision on the outer side of the thigh, and except where the transplant has been a very small one no attempt is made at suture of the cut edges.

Mammary Sarcoma in Old Age.—GRAVES (*British Med. Jour.*, January 17, 1920, p. 81) reports a case of a female, aged ninety-eight years, with sarcoma of the breast and pulmonary metastasis. The lesion was noticed three and a half months previously while the patient was being given a bath. The breast was not enlarged but was painful and several hard, small masses were scattered through the substance of the gland. The axillary lymphatics were not enlarged. Owing to senility operation was not undertaken. The breast rapidly increased in volume and soon attained the size of a foot-ball. The skin became eroded. Shortly before death the patient coughed up a small clot of blood. The microscopic sections showed a large spindle-celled sarcoma.

Subcutaneous Rupture of the Subclavian Artery. — ROUNTREE (*British Med. Jour.*, March 6, 1920, p. 326) reports a case of a male, well-developed, aged forty-eight years, who while pulling a sluice in a lock during rising water suddenly felt a severe pain and experienced a loss of considerable power in the right arm. There was no swelling and no mark of injury, but five weeks later, when examined, the extremity was cold and pale. There was no muscular wasting and all the ordinary movements could be carried out with precision. No pulse could be felt anywhere from the axilla downward. The subclavian pulse could be felt and was equal to that on the other side. A week later color and warmth and a good deal of power had returned. The right radial pulse, although smaller than the left, was palpable. Two years later the pulse was better and could be felt throughout the limb. There was no sign of aneurysm. The author thinks the case was a rupture of the inner and middle coats of the vessel where it crosses the first rib.

The Repair of Cranial Defects by Autogenous Cranial Transplants. — COLEMAN (*Surg., Gynec. and Obst.*, 1920, xxxi, 41) says that in a series of 208 patients, with head wounds, under observation at U. S. General Hospital No. 11, 53 patients were operated upon for the repair of cranial defects. The study of this group of patients provides data for estimating the influence of a skull defect as a factor in the disability of patients with head injuries. The cranial defect may be of slight importance in comparison with the associated brain lesions. The symptoms may be modified to some extent by a cranial defect, and cranioplasty may give a certain amount of relief; but, as a rule, repair of the defect does not benefit conditions resulting from structural brain damage. Scrupulous regard for the limitations of cranioplasty are necessary. These operations should seek to do two things, protection of the brain and relief of deformity. It is the fluctuation of the defect, in various positions, which is mainly responsible for the symptoms which are very characteristic. These patients are disinclined to exercise and suffer disturbed sleep because of throbbing or vertigo when lying in bed. The author says that the symptoms are explained by the local instability of the brain mass, the traction of the adhesions and the associated vascular fluctuations. Cranioplasty should not be attempted until the wound has been healed for three months. Any associate intracranial process accompanied by an increase in tension, intracerebral foreign bodies and sometimes epilepsy make the operation inadvisable. The author used the Charles H. Frazier method of autogenous cranial transplantation. The scar tissue is removed and the dura freed from the bony rim, which is then bevelled with a fine chisel. The dura is not opened. A pattern of the defect is made and placed on the parietal eminence of the same or contralateral side and a thin lamina of the outer table with the overlying pericranium, removed. The graft is molded into the desired curve and fixed with fine interrupted catgut sutures. The patient is kept in bed for two weeks, allowing the horizontal position to give the graft the proper curve. The cranial bones heal without much callus formation. In patients with extensive scars a plastic on the scalp should be done first. The improvement in patients operated by this method is striking.

Homotransplantation of the Kidney and Ovary.—Dederer (*Surg. Gynec. and Obst.*, 1920, xxxi, 45) has transplanted the left kidney and ovary together with their blood supply from one puppy to the neck of another of the same litter. Circulation was continuous with the exception of forty-two minutes, during which time the organs were simply left out in the air in the field of operation. On the evening of the same day urine flowed from the ureteral orifice, in spite of the fact that urine was also being excreted by its own two kidneys. This continued as long as the dog lived. The dog died on the twenty-eighth day following an operation for intussusception. The transplanted organs were removed under operative conditions and were tested as to transplantability by anastomosing the renal vessels to the splenic vessels of another dog. This was only partially successful. The author concludes that it is possible in making a homotransplantation to get a satisfactory arterial anastomosis by suture when the renal artery is less than 1 mm. in diameter. The transplanted kidney passed the same functional tests and reaction to severe constitutional infection as are required of a normal kidney.

Apparent Spontaneous Rupture of a Normal Spleen.—Shorten (*British Med. Jour.*, December 27, 1919, p. 844) reports a case of a soldier, aged forty-three years, who while walking was suddenly seized with acute abdominal pain, localized about the umbilicus. It was so severe that he fell to the ground. He vomited and the pain subsided enough to allow him to walk to his billet. He carried on his duties for four hours and then reported sick. He was given a dose of castor oil, which he vomited. At 6.30 P.M. he arrived at the hospital in collapse, temperature 96.8° F., pulse 130 and feeble. There were no signs of injury. The abdomen was tender and there was board-like rigidity. His legs were drawn up. Both flanks were dull. There was no previous medical history bearing on the case. The diagnosis of a ruptured viscus was made and the patient was operated on under ether anesthesia at 10 P.M. Splenectomy was performed. Hypodermoclysis was given continuously during the operation. Examination of the spleen disclosed a rupture through the hilum. The recovery was uneventful, the patient being evacuated to England four weeks later.

Traumatic Rupture of the Heart.—Howat (*Lancet*, 1920, 1, p. 1313) reports a case of traumatic rupture of the heart, liver and kidney in an adult male, aged twenty-three years. The man fell forty-five feet, alighting on a wooden plank and a pile of steel plates. The death was not instantaneous, the patient dying twenty minutes after the accident in a hospital. Externally there were practically no evidences of injury. Autopsy revealed a badly lacerated liver. There were about two and a half pints of blood in the peritoneal cavity. The right kidney was torn in two places and there was extensive retroperitoneal hemorrhage. The pericardium was distended with blood, due to a rupture of the free edge of the left auricular appendage.

PEDIATRICS

UNDER THE CHARGE OF

THOMPSON S. WESTCOTT, M.D., AND ALVIN E. SIEGEL, M.D.,

OF PHILADELPHIA.

A Case of Chorea Complicated by Gangrene of the Fingers.—CHODAK (*British Jour. Children's Dis.*, July–September, 1919) reports a case of a girl, aged twelve years, who was admitted to the hospital suffering with chorea of a week's duration, and with no history of an antecedent attack. Ten days later the right hand became white and the fingernails blue. In the course of a week gangrene of the finger tips and the ball of the thumb had definitely set in. The pallor spread up the arm. There was no pulse at the wrist, but the brachial artery could be felt pulsating about half way down the arm. The pain became severe. Later the brachial pulse disappeared slowly from below upward and the brachial artery could be felt like a thick cord along the arm. The choreic movements subsided soon after the gangrene began. The gangrene began to fade early and was checked with some loss of function of the hand. There were three possible causes: embolism, arteritis leading to thrombosis, and arterial spasm. The writer inclines to the arteritis being the cause although he draws no absolute conclusion to that effect. There have been other cases of gangrene of the extremities following chorea reported in the literature.

Feeding Solids to Sucklings.—LOWENBURG (*New York Med. Jour.*, January 3, 1920) analyzes the records of 128 cases to ascertain at what ages solids were first given and to note the effect upon alimentary function and nutrition. Of these, 76 received solid food between the ages of six and eight months. He says that the food elements, protein, fat, carbohydrate, water and mineral salts exist in all foods in varying amounts. He sees no reason why these materials as they exist in the vegetable and animal kingdoms, as represented in other foods than milk, when properly prepared, may not be administered to sucklings. Thorough cooking and fine mechanical subdivision provide the means whereby foods other than milk may be made acceptable to the digestive apparatus of the infant. Babies under one year bear well a mixed diet containing comminuted solids. The best age at which to commence their use is probably at six months, although further clinical experience will probably demonstrate that it can be accomplished earlier. This has already been noted in malnutrition in either bottle or breast-fed babies. Even in very young infants of from two to three months an immediate gain occurs following the use of gradually increasing amounts of well-cooked cereals such as farina, cream of wheat, cornmeal mush and the like. The total elimination of milk, a twenty-four to thirty-six-hour hunger period, the use of a saccharated weak tea, followed by the use of the least fermentable carbohydrates (starches), and finely comminuted solids, constitute the correct treatment for diarrhea. Alkalies such as calcium carbonate and fuller's earth are useful additions in that they

check fermentation, favor putrefaction, and are excellent thickening agents. More important than the influence on weight, are the beneficent results noted with reference to mental and physical development and vigor, the increase of tissue tone, and the prevention of rickets and scurvy.

A Study of Achondroplasia.—WHEELDON (*Am. Jour. Dis. Children*, January, 1920) reports 6 cases, which he places in two groups. Three cases comprise the first group, in which the symptoms of dwarf growth were more prominent. In the second group are 2 cases, which showed the symptoms of infolding. The sixth case showed symptoms falling under both classifications. The 2 cases of the second group have a feature, which has never been described before, no mention of it being found in the literature. Each of these cases showed an arcuate kyphos with a point of greatest convexity. In 1 case it was in the dorsal region while in the other it was in the dorsolumbar. Roentgen ray showed a wedge-shaped vertebra at the point of greatest convexity. No disease of the spine could be found, so that the author took the stand that this peculiar vertebra was the result of Jansen's "amniopressure." The same force which presses on the two ends of the spine producing the kyphos might also very easily produce the wedge-shaped vertebra. Two cases of the first group had in addition to the ordinary symptoms of achondroplasia, certain bony changes which could be shown in the roentgen ray. The author believes that these changes are similar to those described by Ehrenfield. The name achondroplasia was chosen for this condition because the state is an aplasia of chondrium. It is characterized by symptoms of dwarf growth such as shortening of the extremities, vertebral column and chest and looseness of the skin, and also by symptoms of infolding, such as kyphosis base os cranii, sagittal narrowing of the foramen magnum, depression of the nasal bridge, narrowing of the choanæ, reduction in the size of the sella turcica with consequent reduction in size of the pituitary body, and changes in the spine. The changes are probably due to the smallness of the amnion except in rare cases. The pathologic changes consist mainly in a retardation of ossification of the epiphysis and diminished production of endochondral bone, while the periosteum produces a comparatively normal amount. These changes of achondroplasia are produced between the third and eighth weeks of intra-uterine life. Besides the deformities of the bone, the characteristic roentgenologic appearance of a long bone under examination shows that near the epiphyseal ends the diaphyses become cup-shaped producing a T-shaped outline without any disturbance of the epiphyseal line or zone of proliferation, though these may be uneven and take on more or less fantastic shapes as compared with those of a normal individual. All of the cases presented in this paper bear out all that has been said and in addition two of them show a new symptom, a wedge-shaped vertebra, which falls in the symptoms of infolding and fortifies the belief that the state of achondroplasia is produced by the smallness of the amnion.

Calcium Metabolism of Infants and Young Children, and the Relation of Calcium in the Stools to Fat Excretion.—HOLT, COURTNEY and FALES (*Am. Jour. Dis. Children*, March, 1920), in this, their second

contribution on this subject, take up the study of children on a mixed diet. They found that with children taking a mixed diet, the absorption of calcium per kilo was lower than that of children taking modification of cow's milk, averaging, when the intake was adequate, 9.955 grams of calcium oxide per kilo. The average daily excretion of calcium oxide in the stools of children taking a mixed diet was 0.87 gram. In regard to the calcium absorption and excretion in relation to fat intake, it was found that the calcium oxide intake per kilo in children taking mixed diets was lower than that of infants, the average for 79 cases being 0.108 gram per kilo. The absorption of calcium oxide when the intake of calcium oxide was more than 0.09 gram per kilo in nearly every case exceeded 0.03 gram per kilo, with an average of 0.055 gram. When the intake was only 0.09 gram per kilo or less the absorption rarely exceeded 0.03 gram per kilo, and in several cases there was a negative balance, the average being only 0.015 gram. The percentage of the calcium intake absorbed when the intake exceeded 0.09 gram per kilo averaged 40.4 per cent.; when the intake was 0.09 gram or less the absorption generally averaged only 20.3 per cent. The inference may, therefore, follow that an intake of at least 0.09 gram of calcium per kilo is necessary to ensure a good absorption by children taking a mixed diet. The best absorption of calcium oxide was observed when the intake of fat exceeded 3 grams per kilo, and when at the same time for every gram of fat there was in the diet from 0.03 to 0.05 gram of calcium oxide. This is a somewhat lower proportion of calcium oxide to fat than was needed to ensure good absorption of calcium oxide by infants taking modifications of cows' milk. When calcium in the form of chalk mixture (calcium carbonate) was added to the diet there was a greatly increased absorption of calcium. When calcium was added in the form of calcium acetate or as calcium phosphate the absorption was not increased. The excretion of calcium was not so closely related to the intake of calcium as in the case of infants taking modification of cows' milk, and was not related at all to the fat intake. A very small intake of calcium resulted either in an absorption not much greater than the amount normally excreted or in a negative balance. The excretion of calcium in the stools was not at all related to the excretion of fat, but bore some relation to the excretion of fat as soap. However, in the constipated stools, which contained the most soap, the calcium excretion was not as great as in the normal stools when the intake of calcium oxide was the same. The calcium lost as soap in the stools of normal children taking a mixed diet was in most cases an insignificant part of the calcium intake. The calcium formed a small part of the total solids of the stools of infants taking modifications of cows' milk. The calcium percentage of total solids was lower in acid than in normal or constipated stools. The two factors chiefly affecting the percentage of calcium in the stools of children taking a mixed diet were the amount of calcium intake and the reaction of the stools. The soap percentage of the total solids followed on the average the variation in the calcium percentage of the total solids. The absorption of calcium by children with chronic intestinal indigestion was extremely low. In the only instances in which the absorption was near the normal both the calcium and fat intake were high. The

excretion of calcium in the stools was very high, except when the intake was unusually low. The excretion of total fat and of fat as soap was very high, but was not parallelled by the calcium excretion. The calcium absorption of children with acute rickets was lower than that of children who were normal, even though the calcium intake was ample. The calcium excretion in the stools was somewhat higher than the average excretion in the stools of normal children. During recovery from rickets the absorption of calcium was higher than the average for normal children. This improvement accompanied the taking of cod-liver oil or additional butter, with a diet containing an ample amount of calcium. The calcium excretion in the stools of children recovering from rickets was lower than that in the stools of normal children. Cod-liver oil increased the absorption of calcium, except in cases in which the intake of calcium or fat was very low. The substitution of vegetable fats for milk fat did not affect the calcium metabolism of children taking a mixed diet.

An Early Diagnostic Sign in Basilar Meningitis.—GINGOLD (*Arch. Ped.*, January, 1920) reports a case illustrating this diagnostic sign of early meningitis. He calls this a "reflex" strabismus. It is elicited by flexing the head on the chest. When this is done either a bilateral or unilateral strabismus develops which will last as long as the head is kept flexed and disappears as soon as the head is relaxed. In many cases the strabismus is accompanied by a retraction of the upper eyelids. He has also noticed a contraction of the pupils in some cases. During a period of seven years of observation "reflex" strabismus was present in the early stages of almost every case that came under his observation. In the late or paralytic stage flexion of the head fails to produce strabismus. By means of this sign he has been able to make a diagnosis of basilar meningitis days before any other meningitic symptom appeared. The difficulty of making a positive diagnosis of tuberculous meningitis in the early stages of that disease is well known. In most cases onset is gradual, and the symptoms are vague and indefinite. There may be no other sign than those of vague digestive disturbance for days or weeks. The diagnosis is especially difficult in young infants since the yielding cranium keeps the intracranial pressure below the fatal limits and often weeks will pass before definite signs appear.

Clinical Interpretation of Scarlatinoid Rashes.—SCHOLTZ (*New York Med. Jour.*, February 21, 1920) offers an interpretation based upon a study of symptomatology, pathology and pathogenesis. He says that scarlet fever rash is not a well-defined and distinct dermatological entity and cannot be differentiated from the rest of scarlatinoid rashes; it is merely a specific type of toxic scarlatinoid erythemata. Scarlatinoid erythema is not an independent clinical entity but merely a symptomatic erythema caused by all varieties of systemic toxins. The differentiation of scarlatinoid erythemata cannot be made on purely dermatological grounds, but essentially on the associated symptoms and the mode of development. Nosologically scarlatinoid erythemata should be regarded as erythematous types of the great generic group of erythema multiforme.

OBSTETRICS

UNDER THE CHARGE OF

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Uterus Bicornis, with Two Ova Implanted in One Horn and a Fibroid in the Other.—CORNELL and EARLE (*Surg., Gynec. and Obst.*, November, 1919) report the following unusual case: The patient had been in poor health, with colic-like pain in both lower quadrants of the abdomen. She had had a severe cold and coughed considerably. She had noticed a bloody, vaginal discharge, which finally ceased. She felt very heavy under the vaginal region while walking and complained of severe pain in the lower abdomen, especially on the left side. She had had several children and several miscarriages, and had not previously been pregnant for ten years; but during this time she had not felt well, although a diagnosis of pelvic disease had never been made. On examination the patient was in fair, general condition, with badly lacerated perineum, a small cystocele and rectocele. There was but one cervix which had been lacerated. On the left side there was a soft, boggy mass about the size of a grapefruit, which was tender and freely movable. Slightly to the right of the median line another globular mass was found, which was hard and thought to be the body of the uterus. This was later found to contain a moderate sized fibroid. The right tube and ovary could be easily palpated; the reflexes were normal throughout; there were no varicosities; temperature, pulse and respiration were normal. A probable diagnosis was made of ruptured ectopic pregnancy, with fibroid uterus. At operation two uteri were found, each about the size of a grapefruit. Each had only one tube, with one ovary attached to it. Evidently one of the uteri was pregnant while the other contained a fibroid tumor. Both cornua with ovaries and tubes attached were removed intact at the junction with the cervix. The left ovary contained the corpora lutea, the right ovary was normal, and was divided in one portion in the peritoneum, the other in the rectal fascia. The abdomen was closed in the usual manner. Subsequent examination showed that the hemorrhage had come from the pregnant uterus. It had evidently proceeded from an incipient abortion. The patient was seen afterward and stated that she had suffered burning pains shortly after she left the hospital. She had many of the symptoms of the menopause, but not as severe as those usually experienced. The area around the ovarian graft in the rectal fascia was normal. The ovarian graft could not be felt nor was there tenderness. On vaginal examination the small portion of the cervix was in good position, but on the left side was a cystic swelling, probably connected with the round ligament. It was not painful. On examination it was found that two ova had been implanted in the pregnant uterus and that their implantation had been so low as to threaten abortion. One ovum was considerably larger, with better developed placenta, than the other indicating that it was several days at least older. One corpus luteum was solid, the other hollow, which would indicate that one was considerably older than the

other. The chorion of one ovum was abnormally small as compared to the embryo and the condition of the ovum and placenta indicated inadequate nutrition. There was a greater amount of lutean tissue in one corpus luteum. It is a somewhat extraordinary fact that during a number of years of more or less ill health the patient had visited clinics frequently and no adequate pelvic examination had been made.

The Analysis of the Signs and Symptoms of Early Ectopic Pregnancy.—HEANEY (*Am. Jour. Obst.*, 1919, p. 17) draws attention to the neglect of cases of early unruptured ectopic pregnancy. In teaching, emphasis is usually placed on advanced and critical cases where rupture has occurred. The student does not suspect ectopic pregnancy, except in the extreme and critical cases. Unless threatening symptoms are present he does not think of this complication. Every patient who presents herself with suspicious symptoms of threatened, imminent or incomplete abortion should be examined, with the possibility in mind that the condition will not be an ordinary abortion, but an ectopic pregnancy. It is specially significant that the cramp-like pains are located at the seat of the pelvis instead of over the uterus. Undue emphasis is also placed on the passage of a uterine cast or small portion of the decidua. In many patients this is never seen. While it is ordinarily taught that the uterus enlarges in ectopic pregnancy, operation shows no appreciable increase in a considerable number. In some patients the uterus is abnormal, while these cases frequently occur in patients in whom the uterus and tubes are undeveloped and in whom ectopic pregnancy is especially liable to occur. Rupture frequently occurs before the tubes are sufficiently enlarged to be recognized by bimanual examination. Failure to palpate a supposed gestation sac in a case of shock and pain should not deter us from operating on an otherwise clear case. The symptoms of a ruptured tube are usually portrayed in an exaggerated manner. The amount of shock depends upon the quantity of blood lost, not merely upon the rupture of the tube. If only small vessels have been severed and the lesion is a small one the patient may have sudden pain, but not necessarily shock, and the pain will be followed by some nausea and weakness. Any woman in the child-bearing age who is seized with abdominal pain of severity, followed by shock or syncope, even though these symptoms be brief, must arouse the suspicion of ectopic pregnancy. Leukocytosis and a normal or subnormal temperature should lead to the diagnosis of probable ruptured ectopic pregnancy when there has been severe abdominal pain, followed by nausea and perhaps vomiting. Exploratory vaginal incision should be practised more frequently in doubtful cases. If a case is sufficiently suspicious to be in a hospital a definite decision should be made, and this can readily be accomplished by a vaginal incision. If there be any ectopic pregnancy the danger to the patient is slight and is more than made good by the accuracy in diagnosis.

Glycosuria in Pregnancy.—CAMERON (*Canadian Med. Assn.*, January, 1919, p. 723) in studying the case of a patient in her fifth month of pregnancy found a small quantity of the reducing sugar in the urine. After the sixth month this disappeared and it was concluded that this was a transient lactosuria. The confinement was tedious and nearly

two ounces of chloroform was used. The puerperal period was uneventful. Within a week from this time the patient developed signs of acute diabetes, and died of diabetic coma three weeks later in spite of vigorous treatment. Since seeing this case in the material of 468 obstetrical cases the writer had four in which there was glycosuria. It is true that lactose and glucose may appear in the urine, with no more significance than demonstrating a normal stimulation of the mammary glands, as they are prepared for lactation, and these substances will often disappear from the urine after lactation is established. In other cases, however, this does not happen and the excretion of sugar in any form or amount shows derangement in metabolism, and when to this disturbance in metabolism a pregnancy is added the condition becomes greatly complicated. There can be no doubt but that the finding of the reducing sugar in the urine of a pregnant woman is a serious matter. Lactosuria is unimportant, but when the patient's urine reduces the copper hydroxide in a test solution the fullest test should be made to determine whether lactosuria is a real condition or not. If there is glycosuria true diabetes may be about to manifest itself or may be already present. Although the sugar may disappear from the urine during pregnancy the patient should be kept under observation afterward. Diet should be carefully regulated, and if the patient comes into labor and requires an operation the choice of an anesthetic is a critical one, and attention should be given to lessening the shock of delivery, and thus delaying the formation of important changes in the organism of the patient. When the regulation of diet does control glycosuria the diagnosis of true diabetes becomes very important. While the frequent examination of the urine is useful and thus furnishes the only means of arriving at definite conclusions by estimating the sugar in the blood with a proper calorimeter the method is simple. Whenever sugar appears in the urine the presence or absence of hyperglycemia should be determined. It may be difficult to induce a patient to use ingestion tests of the carbohydrate.

Pregnancy Complicated by Ileus.—Hansen (*Ugesk. f. Læger*, 1919, lxxxi, 356) has studied the literature of this subject and has collected the reports of 102 cases of ileus complicating pregnancy, of which 57 proved fatal. Operation was done in 64 cases, with a mortality of 45 per cent. and 38 cases were treated without operation, with a mortality of 71 per cent. This condition is usually caused by the formation of adhesions in the abdomen following some previous operation. The pressure of the pregnant uterus on the bowel brings about this complication in a few cases only. There is a difference of opinion concern-in the wisdom of emptying the pregnant uterus in an operation for ileus. In a series of 33 cases reported by one author the abdominal operation was followed by abortion in 24, and this writer recommends the emptying of the uterus by vaginal Cesarean section. Hansen records two of his own cases: The first was that of a multipara, aged thirty-seven years, whose last child had been born thirteen years previously. Since then she had been operated upon for ectopic gestation. Shortly after her last period she had violent abdominal pain. Other symptoms of intestinal occlusion developed, and she was brought to the hospital. At operation a thick, fibrous band was found which was strangulating the small intestine, and was excised. The patient was discharged well a month later and gave birth spontaneously at full term. The second

case was that of a woman, aged twenty-five years, who five years previously had appendicitis and operation. She was six months advanced in her last pregnancy and she was brought to the hospital with symptoms of intestinal obstruction. When the abdomen was opened there was found a fibrous band passing over the small intestine near the ileocecal valve and the transverse colon, and over this band the small intestine had become kinked. The band was tied and removed. The patient made an uneventful recovery, went to full term and gave birth spontaneously. In both of these patients the uterus was left undisturbed.

Toxemia of Pregnancy Treated by Standard Methods.—MOSHER (*Jour. Missouri Med. Assn.*, 1919, p. 1669) describes his experience in forty-four pregnant women suffering from various degrees of toxemia. A considerable number of these cases occurred in a comparatively short time. When an effort is made to account for this it is found that the season of the year was unfavorable, as there were extreme changes in temperature and moisture, and that at this time the people of the United States were subjected to great excitement through the development of the recent war. All patients are examined with a view to detecting the signs of threatened toxemia. Blood-pressure is taken, eye symptoms are noted, the urine is examined and the teeth and tonsils are inspected as possible foci of infection. Clinically speaking the writer believes that eclampsia results from the failure of elimination of toxins. In the early portion of pregnancy he believes these toxins are formed in the placenta, while later they arise from the excretions of the fetus. Acute infections of various sorts predispose to toxemia through the additional burden thrown upon the pregnant woman. Asphyxia resulting from pressure, congestion, decrease in the natural oxygenation of the woman's blood, due to interference with the expansion of the lungs and the action of the heart, may also predispose to toxemia. Whenever eclamptic convulsions develop some focus of infection will be found. In prophylactic treatment the writer believes that a diet of non-irritating food is of primary importance. The action of the bowels, kidneys and skin must be stimulated and the intake and output of fluid should be carefully observed and recorded in a daily report. Care should be taken to eradicate foci of infection in the tonsils, teeth, kidneys and bowels. Deep breathing in fresh air and stimulation of the general circulation are important. The free giving of alkaline salts and food to prevent acidosis is of value. Should blood-pressure be high, veratrum viride may be given to reduce pressure, lessen the pulse-rate and aid in the action of the skin. When a patient grows worse under such treatment the uterus must be emptied. This should be done in the least irritating way, and should be carried out promptly so soon as prophylactic treatment fails.. The prompt improvement of the patient after this operation is a fact familiar to all. Ether anesthesia is employed, as this is the only safe anesthetic for use in these cases. The writer's method consists in preliminary gradual dilatation by solid dilators up to No. 20 and then introducing a Voorhees bag No. 4 if at term. After the dilatation has reached a point when vaginal delivery can be accomplished without serious laceration the bag is removed and the patient advised to deliver herself if she can do so. If spontaneous labor fails she is delivered by forceps. Moderate hemorrhage from the uterus is encountered.

GYNECOLOGY

UNDER THE CHARGE OF

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Prolapse of the Uterus. — From the observation and experience gained in the treatment of fifty consecutive cases of prolapse of the uterus during the past six years, as well as from watching and seeing the results of other types of operation for prolapse, COVENTRY (*Minnesota Med.*, 1920, iii, 286) believes that his results give by far the greater percentage of cures, not only anatomically but also symptomatically. In those cases coming under first degree, or as one might say, in those cases headed toward a prolapse, he prefers the Baldy-Webster operation, and repair of the perineum and cystocele has been sufficient to give the patient a great deal of comfort and to cure these cases. In the second and third degree prolapse cases, one must here use some judgment before deciding on the exact type of operation that one wishes to do. As said before, cystocele invariably is present. In these advanced cases he believes that there is only one type of operation that combines safety, comfort to the patient, and the largest percentage of cures, namely the interposition operation, whether after the so-called Wertheim-Watkins or the so-called Mayo method. If the uterus is of good size and not atrophic he prefers the former: if atrophic, by all means the Mayo method. It may not here be amiss to go into detail as one proceeds with the operation. After thorough application of iodin, the cervix is grasped with tenaculum forceps, and an inverted "T" incision made in the anterior vaginal wall. Then by gauze and blunt dissection the bladder is readily freed, both laterally and anteriorly. There is practically no danger of injuring the ureters, because before you come to them you will undoubtedly get into a plexus of veins which, however, one should guard against rupturing if possible. The bladder is now freed from the anterior uterine wall and the anterior cul-de-sac entered, taking great care not to tear into the bladder. Many times one can determine at this point whether he should do the Wertheim-Watkins or the Mayo type of operation. If the Wertheim-Watkins operation, the fundus of the uterus is grasped and pulled down and out so as to expose it at the vulva. At this stage, if one should have adhesions posterior, they can be freed, or if fibroids should be encountered they may be taken care of as one thinks best. After the uterus has been pulled forward and the bladder has been shoved up, the anterior peritoneal flap is now stitched to the posterior uterine wall. At this stage the uterus is practically extraperitoneal. The redundant anterior vaginal wall is now excised, and by interrupted

stitches, which include the anterior uterine wall, the anterior vaginal wall is closed. The vaginal wound is then closed. In closing the anterior vaginal wound, two important stitches must be inserted: (1) The most anterior stitch must be so placed as to pass through the vaginal wall picking up the deep fascia lying laterally to the urethra, and then passing through the fundus rather high up, coming out in the reverse order on the other side. This tucks the bladder well up and places the fundus snugly under the pubes. (2) The other stitch of importance is the one in the anterior cervix, placed so as to make a firm union of perimetrium, uniting in front of the cervix, and in this way the cervix is pushed well posterior. The short arm of the vaginal incision is now stitched laterally, so as to elongate the anterior vaginal wall. The cervix may be repaired or amputated as one sees fit, but here it must be borne in mind that the bladder is often dragged far down on the anterior wall of the cervix, especially when elongated. If one proceeds to do the Mayo method the short arm of the inverted "T" incision is carried around the cervix and a vaginal hysterectomy is done, the broad ligament and the perimetrium being united in the center, and this brought down as a shelving portion, taking the same place that the uterus takes in the Wertheim-Watkins operation. This elevates the bladder and gets rid of the cystocele at the same time preventing any hernia of the pelvis. The next, and very essential step, is the repair of the perineum.

Radiation of Uterine Cancer.—For purposes of classification and treatment, Boggs (*Am. Jour. Roentgenology*, 1920, vii, 202) divides cancer of the cervix into four groups: (1) Early cases, where the growth or ulceration is limited to a part of the cervix and does not extend into the vaginal wall. Even in these early cases recurrences take place, and even metastases into the glands may have occurred before the operation. (2) Where the process is more advanced and clinically the involvement is still limited to the tissues of the uterus because the organ is freely movable. Cases of this class may include cauliflower growths, which protrude from the cervix and often fill the greater part of the vagina. Even in these cases the cancer cells may not have reached the pelvic lymphatics. This is a class which will derive great benefit from anteoperative treatment, and by such procedure the end-result should be better. (3) Where the disease is further advanced and the carcinoma extends into the vaginal wall. There is slight fixation of the uterus, but clinically there is not extensive involvement of the broad ligaments. If there is no glandular involvement, which we can never determine clinically (although, as before stated, the glands are often free in cases of this class), rather a high percentage may be clinically cured by radium treatment. Time alone will tell whether or not we should depend upon radium alone, even if we have obtained brilliant results by radium in a number of instances. (4) Cases of carcinoma of the cervix, with marked fixation of the uterus, the disease extending into one or both broad ligaments with involvement of the vaginal wall and the greater part of the cervix destroyed. In many of these cases glandular involvement has taken place and in some instances metastases have extended into the liver. These cases often will derive a great deal of benefit from radium and a local or clinical cure frequently will take place. But even if

metastases have been extensive the patient may remain free from cancer symptoms from one to three or more years. A cure might be effected, but with our present method of treatment we always expect the patient to die from metastases rather than look for a permanent cure. When it is considered that about one-third of the cases of cancer of the cervix that receive no treatment die within a year without an operation, that a large percentage of the remainder die within two years from the first manifestation of the disease and that very few live three years, it is apparent that the amount of palliation and prolongation of life from radium treatment (and the fact that many of them die of internal metastases without return of the local symptoms), mean much to the patient. Today radium is indicated as a palliative measure for hopeless inoperable and recurrent cases as an anteoperative procedure and for prophylaxis after surgical removal. Lately radium is being used by some physicians for primary cases in carcinoma of the cervix when the disease extends into the cervical canal, because nearly all of those cases are followed by recurrence even in the early cases after operation. The malignant process in these cases will disappear by radium rather promptly. Time alone will tell whether radium without operation is advisable. Radium is a specific palliative in operable cancer of the cervix and uterus. It will clinically cure some of the cases, and subjective improvement is noticed in a certain percentage of others. However, recurrence takes place in many of these clinically cured cases within two or three years. The patient during this interval regains normal health and can lead a useful life. If a recurrence takes place, as a rule, the patient suffers little in comparison with those who had no radium treatment. In these hopeless cases, the offensive discharge and hemorrhage usually completely disappear within from two to four weeks. The cessation of discharge which often is so offensive to the family and even to the patient is a remarkable feature. The local condition changes in character within from two to four weeks after the treatment, the mass begins to contract and shrink, and continues to decrease in size. This is more marked in some instances than in others. The deodorizing and sterilizing effect of radium is very remarkable in the inoperable or recurrent cases where there is a broken down mass of carcinomatous tissue or a crater-like sloughing extending into the broad ligament. These cases have a discharge with a very foul odor and run an irregular temperature. One application of radium will alleviate these symptoms and means much to the patient.

Vaginal Palpation of the Ureters.—The normal ureter, according to JUDD (*New York Med. Jour.*, 1920, cxi, 986), is easily palpable from the side of the pelvis, just above the spine of the ischium, although in some cases it lies as much as 4 cm. above the spine, where it lies underneath the peritoneum and previous to entering the broad ligament in the course of its entrance into the bladder. Undoubtedly in the case of a thickened ureter from ureteritis, or from any cause whatever, it can be easily palpable to a far greater extent, as has been exemplified in some of his own findings. Contrary to the general method advised, which is that palpation be made for the ureter in the anterior vaginal fornix, he suggests beginning at the lateral vaginal fornix, using the left index

finger for the left ureter and the right index finger for the right ureter. The normal ureter presents itself as a slender cord, with its convexity outward, and with a restricted mobility, due to its anatomical relationship with the peritoneum and side of the pelvis. It is smaller than a goose quill, feeling about the size of an ordinary shoestring. It is best palpated by sweeping the finger above the point of its location and then slightly bending the end of the finger, as one might in picking the strings of a guitar, sweeping them down over the ureter, straightening the finger out and going back and bending it again before going down, always getting the feel of the ureter from above downward and not from below upward. Palpation of the ureters opens a great diagnostic field. Among conditions discoverable, according to Judd, are the following: An acute ureteritis, diagnosticated by simple tenderness along the line of the ureter. Chronic ureteritis and periureteritis are shown by tenderness and thickening, the greater the extent of the periureteritis, the greater will be the lessened mobility of the ureter. Tuberculosis of the ureter and kidney gives a thickened, nodular feeling with tenderness and restricted mobility. Calculi and gravel in the ureter furnish a most brilliant field for diagnosis. It is Judd's belief that these conditions can often be detected where the wax-tipped ureteral catheter fails to disclose a stone, particularly where the stone is smooth and pocketed.

Contra-indications to Nephrolithotomy. — Before deciding upon operation in cases of stone in the kidney or ureter, BRAASCH (*Minnesota Med.*, 1920, iii, 387) states that we should consider the duration of symptoms, the size, situation and number of stones, the question of bilateral lithiasis, the renal function and complications in other organs. The duration of symptoms should be a considerable factor in determining the advisability of immediate operation since it is not generally realized that probably 75 per cent. of renal stones pass spontaneously. The majority of these stones will probably pass within three or four months following the first symptom. It may be stated, therefore, that it is usually inadvisable to operate for a stone in either the kidney or ureter until at least three months, and possibly six months have elapsed since the onset of the symptoms. Immediate operation for stone following the first or second attack of pain, without evidence of other complications, is strongly to be condemned. Nature should be given full opportunity to remove the stone without intervention. There may be exceptions to this rule, such as excessive pain continued over a duration of several weeks or months, evidence of acute perinephritic or cortical infection, and evidence of urinary retention sufficient to endanger the kidney. Moreover, when it is evident that the stone is too large to pass, nothing is gained by further delay even though the onset of symptoms is very recent. If the stone is less than 2 cm. in diameter, operation should be delayed. If the stone is situated in the cortex of the kidney, the urgency for operation is not so great as when the stone is in the renal pelvis. If multiple stones are present, it is usually advisable to operate irrespective of the size of the individual stones. In cases of bilateral nephrolithiasis, if there are no acute symptoms and the stones are large and multiple, operation is usually inadvisable. Removal of such stones situated in both kidneys is usually accompanied

by considerable destruction of the kidney tissue, and the chances are the patient would live as long and as comfortably without operation. When the symptoms are acute and unilateral, however, operation is of course indicated. Low renal function usually contra-indicates operation, although if the symptoms are very acute, operation may be justifiable even under such conditions. A renal functional test of from 20 to 30 per cent. in the presence of lithiasis, particularly when bilateral, will frequently become approximately normal after the stones have been removed. When the phenolsulphonephthalein return is only a trace, however, and the urea retention is high, operation should not be considered unless the symptoms are urgent. In cases of stone in the lower ureter, in justice to the patient an attempt should be made to dislodge the stone by cystoscopic manipulation before resorting to operation. Braäsch has been able to cause the stone to pass following such manipulations in 126 cases; but he believes that when the stone has been lodged in the lower ureter for from three to six months or longer, or when it is larger than 2 cm. in diameter, the possibility of its dislodgment by cystoscopic methods is greatly diminished. Such manipulations are also contra-indicated when there is acute renal infection, intolerance on the part of the patient to the cystoscope or anatomic deformity.

HYGIENE AND PUBLIC HEALTH

UNDER THE CHARGE OF

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Psychiatric Studies of Delinquents.—TREADWAY and WELDON, U. S. Public Health Service, and HILL, Special Agent of the Children's Bureau, U. S. Department of Labor (*Public Health Reports*, No. 27, xxxv, 1575) report the results of studies on the mental and medical aspects of prostitution, and draw the following conclusions and recommendations: The presence of so many psychopathic individuals among the groups studied indicates that the problem of delinquency—and particularly of sexual delinquency among girls and women—is a medico-psychological as well as social one. Moreover, the findings of this study as they relate to the make-up of these offenders show the importance of recognizing and understanding certain types of mental reactions in children, which frequently lead to the development of antisocial traits of character in later life, in order to institute suitable methods of corrective training. The findings indicate the need for an adequate system of medical supervision of children in the schools. The principles of personal hygiene should be taught; a dentist and dental equipment

provided; a specialist in diseases of the eye, ear, nose and throat should serve on the medical staff; and funds should be provided for the purchase of glasses. Similar supervision, instruction, and provision should obtain in all correctional institutions. Another important step indicated is that medical supervision of school children shall be made to include not only the discovery, correction and prevention of physical defects, but the detection, also, of such tendencies of behavior as those referred to above, which may later develop into serious defects of mind and character. Such inspection should be part of the State health program, and this program should also make reportable feeble-mindedness and certain forms of insanity. Since mental defect is so conspicuous in cases of delinquency, the importance of mental hygiene is evident in the control of delinquency as well as in the control of venereal diseases. Supervision of the mentally defective in the community—the establishment of special classes in public schools for training mental defectives and delinquent children—will also serve to prevent delinquency and the social ills caused by inadequate care of the feeble-minded. The level of intelligence is likely to be low among delinquent women. Among the group studied it varied considerably. Cognizance must be taken of this fact in establishing a school for their training. Moreover, the difference in mental attainments suggests that individual training should constitute, in large measures, the method of such a school. Further, the frequent concurrence of mental disorders among the group studied indicates that provision should be made in special State institutions for those children who are unable to profit by special school classes and for those feeble-minded, epileptic and insane persons who exhibit distinct antisocial tendencies. Similar provision should be made for psychopathically inferior individuals not generally recognized heretofore as in need of institutional care. The mental status of all individuals in correctional institutions should be considered by a medicopsychologist before they are paroled, and a medicopsychologist should serve in the juvenile and adult courts for the purpose of securing proper mental classification of offenders, thus preventing injustice in disposing of their cases. A State institution for the feeble-minded which admits only those idiotic and imbecile persons under fifteen years of age who are incapable of instruction in the public schools is not an adequate provision for all those mentally defective individuals who complicate the delinquency problem. Proper care and protection should be given also to the feeble-minded who are actual delinquents or likely to become so. By this means the danger to society in general would undoubtedly be lessened. The cost of adequate provision for the feeble-minded would be less than the cost to the community of their neglect and consequent antisocial conduct. The Kansas Legislature recently passed a law allowing the commitment of mentally defective delinquents to the State institution for the feeble-minded without the consent of parent or guardian. This study has made clear the necessity for such provision. In public and private relief agencies mental examinations by a competent psychologist or psychiatrist should be given members of families coming to their attention, especially those furnishing difficult problems. Such an examination not only would be of great assistance to the agency in making adequate plans for treatment, but also would prove

helpful in many cases by giving a starting-point for the diagnosis of causes of immorality in the cases of certain specific individuals. It is a shortsighted policy which refuses to admit to an industrial school delinquent girls suffering from venereal diseases, but makes no other provision for the training or care of such girls. While it serves the immediate purpose of protecting the girls already in the institution, it allows to remain unchecked sources of danger to public health and to the social standing of the community. Neither is that policy adequate which quarantines the girl until the infectious stage of the disease is past and then turns her back into the community. Morally delinquent girls should, where the evidence warrants, be committed to an industrial school, whether venereally diseased or not; subsequent to commitment, but prior to mingling with girls already within the school, infected girls should be given treatment until danger is past in a quarantine cottage attached to the school or in some other designated place. Where morally delinquent girls and women are quarantined in the same institution the juvenile and adult delinquents should be cared for separately. It is unfortunate that in the present situation children as young as fourteen must, because of the necessities of the method of providing medical treatment, associate with older and more hardened women. The age through which girls are protected by laws in regard to age of consent is an important factor in lessening immorality. The legal age of consent in Kansas is eighteen years, yet though 29 of the girls included in this study were under eighteen years of age at commitment, and at least 56 (all but 10 of those for whom the age at first lapse from moral conduct was known) had been first immoral before reaching the age of eighteen, there is no evidence to show that any man was brought into court for violating the law in regard to age of consent in respect to any one of these girls. The man's responsibility for contributing to a girl's delinquency and for the spread of venereal disease should be better recognized, and the man should be punished as well as the girl or woman. It was known that 2 of the inmates of the Kansas State Industrial Farm at the time this study was made had become diseased through the same man, yet the man was allowed to go free. While some measure of correction may be required, moral delinquency can be curbed better by preventive than by corrective measures. To be effective preventive work should be undertaken early, since the morally delinquent usually enter upon their careers when young. The inadequate supervision of children which results from the absence of a mother from her home because of gainful employment is conducive to moral delinquency. Provision which would obviate the necessity for such employment or secure adequate supervision for the children should be an effective means of reducing juvenile delinquency. Also certain economic changes whereby all women who work can earn sufficient to enable them to live in decency and comfort and have a reasonable amount of time and money for recreation will have to be brought about. Finally, these studies have shown that fundamental among the factors of prostitution are the normal and aggressive reproductive instinct of the male and the ignorance, inferiority and defenselessness of a large number of girls and women whose mental condition makes it difficult or impossible for them to make a living by legitimate means. It seems that the large majority of these women derive little or no satisfaction from their soliciting, but

follow prostitution as a sordid commercial arrangement, believing, and without doubt, correctly, that they can, for the time being, secure more compensation and physical comforts by prostitution than by engaging in any legitimate occupation which they are qualified to follow. The great majority of these women, owing to inherent defect or lack of opportunity for education and training, have extremely few interests, and can exist only by the most menial occupation. It is realized that a study of a group of delinquent women, in many individuals at least, is a study of an end-product of bad heredity or poor environment, or both, and is usually barren of immediate reconstructive results. A better understanding of such persons will require a more individual study, beginning in early childhood. To this end, as already suggested, the teacher must be interested, the school physician should have some knowledge of psychiatry, and if possible the services of a skilled psychiatrist should be utilized for consultation in the case of the peculiar or unusual child. It seems clear also that a large percentage of these women who pass through the courts and drift in and out of various penal institutions should be regarded as in some way mentally abnormal until proved otherwise by a mental and physical examination conducted by a competent psychiatrist. Modern laws relative to educational standards, with proper enforcement, will aid considerably by diminishing ignorance in those who are educable and in aiding them to a status wherein they can earn a reasonable living wage in a legitimate occupation. In the case of those who are clearly defective, and who are a menace to a community through their delinquency, there remains no solution but permanent detention under conditions where they can be made at least partly self-supporting. But after these more obviously needed changes are well on the way to solution, there will remain the problem of that great number of women who engage in clandestine or intermittent prostitution, in whom the demonstration of mental defect, to the satisfaction of the jurist, will often be extremely difficult. The history of prostitution is replete with instances of attempts at repression by the harshest measures and with little permanent result. At the present time such measures alone will accomplish but little in connection with the clandestine and occasional prostitute. The final solution of that problem is, perhaps, most of all a matter of social sentiment and conviction. Recently we have heard much about the suppression of prostitution, and the abolition of alcohol as a beverage will undoubtedly accomplish considerable good; but there will still remain, however, certain fundamental factors, such as inherent human defect, ignorance, adverse economic conditions, the power of the reproductive instinct, and the inability of many persons to live satisfactorily in the married state.

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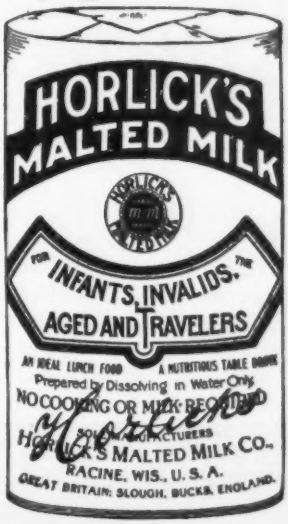
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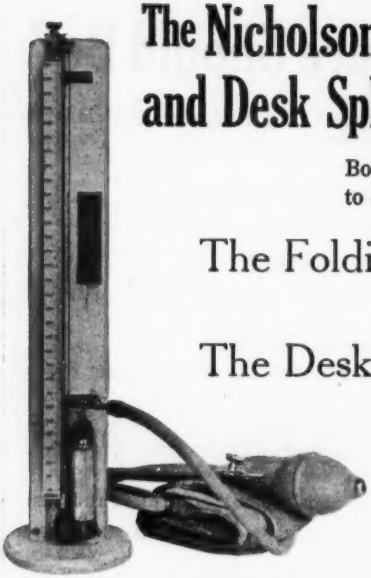

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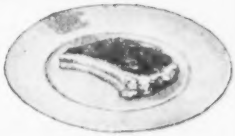

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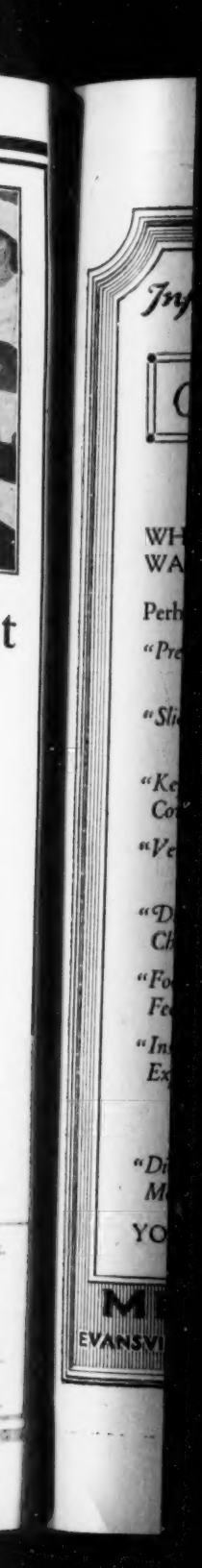

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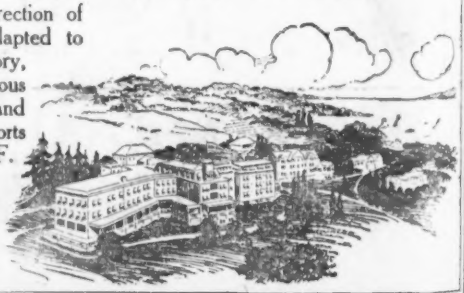
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